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December 1965

AREA-WIDE SHELTER SYSTEMS

Prepared for:

OFFICE OF CIVIL DEFENSE
DEPARTMENT OF THE ARMY - OSA
WASHINGTON 25, D.C.

OCD-OS-63-149
OCD WORK UNIT 1631A

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STANFORD RESEARCH INSTITUTE

MENLO PARK, CALIFORNIA

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By: RICHARD I. CONDIT

SRI Project MU-4536

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AREA-WIDE SHELTER SYSTEMS
By Richard I. Condit
Stanford Research Institute
December 1965
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SUMMARY OF FINAL REPORT (Detachable)

Many reports of previous research describe particular aspects of civil defense, such as identifying fallout protection in existing buildings, designing new blast shelters, providing warning, insuring emergency communications, etc.--detailed considerations of restricted subject areas. This report is broader in nature, combines such particularized results, and shows how the people of a region may make integrated arrangements for community protection--how they may develop area-wide shelter systems. It describes the general principles of community-wide protection, while applying them specifically to the City of San Jose, California.

Based on the knowledge of what it takes to provide various degrees of protection from the effects of nearby and distant nuclear explosions, the planning of area-wide shelter systems starts with an inventory of the existing community resources of possible value for protection. In San Jose, this includes the results of the National Fallout Shelter Survey, improving those spaces with additional ventilation, and upgrading them against blast and fire; home basements; special facilities; covered storm drains; and the protection potential of creeks and standing water. To these are added the possibilities for new construction, stretching from emergency trenches and fox holes to carefully prepared blast and fallout shelters.

While the nature of the protective shelters to be utilized necessarily varies with the weapons effects to be resisted, in important cases the location of those shelters is also critical. In particular, it is highly advantageous to have protection against direct effects (e.g. blast and fire) located in the interiors of large open incombustible areas within the community--public school grounds, parks, and the like--to minimize difficulties from blast, fire, fumes, and debris. On the other hand, where radioactive fallout is the only threat, shelters are indifferent to location. Other things being equal, fallout shelters can equally well be located anyplace, in regions where blast and fire from nuclear explosions are not anticipated. In San Jose, it is shown that existing public school grounds and parks are sufficiently large and suitably located (i.e. closely coupled) for the existing population so that civil defense facilities erected thereon can be quickly loaded in an emergency.

Because of blast and fire effects, planning protection from the direct effects of nuclear explosions calls for special concern for those parts of the community of appreciable extent which are more built up than typical light-residential areas. (No such distinction is necessary for fallout protection.) In San Jose the heavier-than-light-residential construction of concern is all downtown. This region must be evaluated (1) for areas susceptible to a fire storm and (2) for areas from which fire escape may be difficult or impossible post attack. The probable occurrence of either of these creates additional constraints on protection procedures and confidence. Both are found in San Jose.

Eight area-wide shelter systems are worked out and presented for San Jose--four for protection against direct effects and fallout, and four for protection against radioactive fallout only. Both sets of four attempt to span the range of possibilities from doing the best you can with what you have, to building a new system to fit the needs. Accompanying procedures for increasing emergency-readiness in case of a warning rise in international tensions are also indicated.

The effects of each plan are evaluated quantitatively in terms of the minimum time required to shelter the population, and the maximum protection provided when sheltered. Qualitative remarks are made concerning the living conditions of each arrangement of shelters. Since the identified shelter in San Jose is grossly inadequate for either fallout or direct-effects protection of the population as a whole, the more rudimentary area-wide shelter systems (i.e. those having no large component of new shelter construction) necessarily employ reduced space allocation, inferior protection factors and habitability, and last-minute augmentations of existing spaces by the expedient construction of covered trenches in large open areas within the community. It is shown that considerable passive protection from nuclear attack can be obtained one way or another with area-wide shelter systems in San Jose.

ACKNOWLEDGMENTS

This report depends in large measure on the work of the following assistants and associates at SRI:

Bernard L. Gabrielsen
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Mrs. Mary L. Frederick

They were responsible, among other things, for the detailed data collection, analyses and maps for San Jose.

Their efforts would have come to very little were it not for the excellent co-operation and effective help provided to this study by the Civil Defense staff of the City of San Jose:

Mr. Charles C. Rehling
Mr. Melvin McDonald
Mrs. Dorothy Gimelli

We note with extreme regret the loss of Mr. A.R. Lunsford as head of Civil Defense in San Jose, and a man of many accomplishments in that position. He passed away just as our contacts with San Jose Civil Defense were starting.

Considerable data concerning the community were provided by the Planning Commission and Public Works Department of the County of Santa Clara; by the City of San Jose Planning Commission and Departments of Public Works, Parks and Fire; by the several School Districts involved: Alum Rock Elementary, Cambrian Elementary, Campbell Elementary, Franklin McKinley Elementary, Moreland Elementary, Union Elementary, San Jose Unified, Alum Rock High School and Campbell High School; and by Mr. Frank Wagner of the U.S. Navy Bureau of Yards and Docks, San Bruno, California (National Fallout Shelter Survey).

We sincerely appreciate and gratefully acknowledge these essential contributions.

CONTENTS

CONTENTS

CONTENTS

APPENDIXES

FIGURES

FIGURES

FIGURES

TABLES

TABLES

I INTRODUCTION

Background

This is the final report for the Office of Civil Defense (OCD) resulting from the Stanford Research Institute (SRI) study of area-wide shelter systems. Various background reports for the present work have been furnished previously to OCD.

General guidelines for this study were provided by the following:

> **Scope of Work***
>
> To properly plan solutions of the many problems arising in determining the total requirements for shelter in an area-wide complex, it is required that data on the contributing systems and factors be developed. With the concurrence of the Government an area such as a metropolitan area, bedroom community, industrial complex, college or commercial city, or major segment of these shall be chosen. Recognition shall be given to any such community for which partial data on major elements contributing to the design of an area-wide shelter system exist. Analyses shall be made of the interlocking requirements for functions such as warning, transportation, communication, fire fighting, rescue, and decontamination as they influence the characteristics of a complete community shelter system. Consideration shall be given the legal, fiscal, supply, economic, and organization problems for which solutions must be obtained in the system analysis. The extent of a study of unique situations demanding detailed study of a particular facet of the shelter plan for a community shall be determined in coordination with the Government, with consideration for its potential contribution to the overall shelter system for the area.

Many of these requirements have been the subject of previous reports.

* Taken from the research contract between OCD and SRI.

The particular area chosen "with the concurrence of the Government" to apply the concepts generated by this research was the City of San Jose, California. It was recommended for this application because of its involvement in the large scale OCD "Five-City Study."

Intent of this Report

Our basic aim is to show how people can be protected from nuclear attack with area-wide shelter systems in San Jose, California, under various circumstances. Additionally we would indicate wherever these results appear to be useful for protection elsewhere.

Our basic procedure has been to first analyze the problems of creating area-wide shelter systems from a conceptual point of view (as reported in previous reports). As a second step, these concepts were applied to the particular community of San Jose. Third, that very application sometimes made us realize that other principles of protection, previously overlooked, were needed. Fourth, came the attempt to determine the new missing concepts and their proper interrelation with those already evident. The new integrated total understanding was then applied to San Jose as a fifth step, etc. Thus concepts preceded applications which stimulated further concepts requiring additional applications begetting still other ideas, and so on. The procedure has been regenerative.

So this volume goes beyond the simple application of previous concepts. For that application gave rise to other concepts--as did later applications. Thus we must of necessity speak here of concepts newly generated as well as concepts previously reported. Concepts and applications will be the two sides of our coin.

Describing various systems of protection appropriate for San Jose, California, is our primary intention. However, we would make the utility of those results as widespread as possible. So while speaking of protective systems for a particular place, we also watch for those features having a more general value for protection. We will be dealing in specifics, some of which deserve general application. We would not lose the forest in the trees; we would not miss the trees in the forest. We would give proper due to both specifics and generalizations.

We Are Planning Protection

Much of the current research in the Five-City Study aims at assessment--preferably detailed accurate assessment by acknowledged experts of nuclear weapon effects. To allow tangible consistent results to be obtained, a particular "standard" national attack has been formulated by OCD for use as the first attack to be evaluated in the five cities. We will certainly consider the impact on San Jose of the first official Five-City Study attack. But we will also consider, in principle at least, many other possible attacks--and many other communities. For our ultimate objective is the design of area-wide shelter systems--not just in San Jose, but anywhere, not just to protect against Attack No. 1 (of the Five-City Study), but to be generally protective.

Thus is our major concern with the planning of protection, not with detailed assessment (except insofar as that assessment furthers protection planning). And in general we expect more benefit (for our planning purposes) from several approximate evaluations of a number of different plausible attacks than from a very detailed analysis of any one particular set of attack circumstances.

San Jose as a "Direct-Effects" or "Fallout-Only" Region

Early in any serious planning for protection against nuclear attack it is necessary to determine whether the region involved is likely to be exposed to (1) the direct effects of nuclear explosions (flash, blast, fire and perhaps prompt nuclear radiation), or (2) just the radioactive fallout from an explosion a considerable distance away (too far away for significant direct effects to be experienced). For planning purposes we recognize that San Jose could be classified as a "direct-effects" area--subject to direct effects and radioactive fallout as a consequence of a large scale nuclear attack of the United States. This categorization happens to correspond with the first attack of the Five-City Study, from which San Jose--while not itself attacked--does experience appreciable direct effects from a nearby weapon. For the purposes of this study, San Jose is assumed to require protection against direct effects and radioactive fallout. Thus San Jose is considered a "direct-effects" region for protection planning purposes.

If then we kept strictly to the above case for San Jose, we would not consider it for fallout protection only--and this report would necessarily be limited to planning for direct-effects protection. Since the provision of fallout protection is the current national program, and since we believe we have some results of interest for that program, we would like to include suggestions for "fallout-only" regions. Accordingly we will treat two different San Joses. There will be San Jose (Direct Effects)--a "direct-effects" region requiring protection against flash, blast, fire and fallout; and there will be San Jose (Fallout Only)--a "fallout-only" region, exactly the same as the other San Jose except that it need be protected against radioactive fallout only.

Our primary concern will be with San Jose (Direct Effects), and its protection against direct effects and radioactive fallout. Attack No. 1 of the Five-City Study does subject San Jose to direct effects, but from an air burst which produces no fallout. Additionally we shall give some attention to San Jose (Fallout Only), to consider how one would provide protection for the people in such a community if fallout were their sole potential hazard. We will refer to the "direct-effects" case as either "San Jose (Direct Effects)" or as "San Jose"--without special designation. We will try to always specify "San Jose (Fallout Only)" when we consider protection limited to fallout-only for the people of that community. To help keep these distinctions in mind, the pages of this report which deal solely with San Jose (Fallout Only) have been given an off-white tone, to further emphasize the special conditions involved.

Actors and Actions for Civil Defense

The obvious entities capable of taking action for civil defense are the Federal Government, State Governments, Local Governments, Other (non-governmental) Organizations, and Families/Individuals. And of the principal acts which could conceivably benefit civil defense, some are more readily accomplished by certain of these parties than others. However, because our focus is on the local situation of San Jose, our major moving forces tend to be restricted to

Local Governments

Other Organizations

Families and Individuals

Viewed from the local community, the actions of the Federal and State governments influence and motivate (along with other factors) the three principal on-the-spot actors listed above.

In what follows, we wish to determine what each of the above entities should or could do for civil defense under various circumstances. Always the aim will be to further protection, either collectively or individually. While acknowledging: (1) that the present Federal Civil Defense Program emphasizes the development of community shelters, and (2) that few persons can provide their own protection wherever they go (because of the mobility normally necessary in these times); (3) we also realize that the present protection in many communities is very low and informed and alert individuals, families and organizations could readily provide far better protection with their own resources--at least in one location. So it seems necessary to contemplate both community and non-community approaches to area-wide shelter systems in San Jose.

If protection is needed and not provided by the community, what else can an individual or organization do but to try to stimulate community action and (if necessary) develop the protection he can on his own? We hope to show useful courses of action for this eventuality. And it seems appropriate for civil defense agencies at every governmental level to do what they can not only to further the Federal Program for community fallout shelters, but also to help individuals and

organizations to provide their own better protection (usually limited to one locality) where that is their desire.

* * * * *

This Volume deals with a restricted and definite problem: Providing the protection for area-wide shelter systems for the people of San Jose, under various circumstances. The resulting detailed plans are believed to be of value (1) in their own right for this one community, and (2) for the implications they have for other communities.

II CHOOSING PASSIVE PROTECTION GOALS OR LIMITING THE EFFECTIVE SIZE OF ENEMY WEAPONS

Our aim is to sustain life in the face of nuclear attack. If there is nuclear attack there are nuclear weapons, and nuclear weapons which belong to an enemy. That enemy is presumably free to choose the size and number of nuclear weapons destined for a particular U.S. target or area (to the limit of his technical and production capability). We in turn are normally free to attempt to (1) convince him not to use his weapons against us, (2) prevent him from using his weapons against us, (3) interfere with the weapons he does send against us (to reduce their effectiveness) and (4) implement passive countermeasures to protect U.S. people from the effects of his nuclear attack. In this report we shall be concerned with just the last of these strategies--passive protection, civil defense. This limitation carries no inference as to the importance of civil defense relative to the other parts of our national defense. Suffice it to say that civil defense is viewed here as an essential part of that defense.

In selecting the extent of that civil defense, in choosing our passive protection goals, we determine in large measure the future effectiveness of delivered enemy weapons. While the enemy is free to choose his weapons, we are free to choose measures to limit their effects. Considering just the civil defense component of our national defense, it is always the <u>combination</u> of enemy weapons and U.S. passive protection which determines the physical consequences of a given nuclear attack. The enemy can try to make things worse for us by using more and/or bigger weapons; we can try to make things better for us with more and/or better civil defense, i.e. in this case: more and/or better shelters. While the enemy is free to choose his weapons, we can influence their effectiveness by our choice of passive protection (among other things).

By our choice of protection, we determine the effective size of enemy weapons. Thus we are free to make large enemy weapons appear huge, large, medium-sized or small, depending on the passive protection we implement. We can reduce the apparent size of the enemy's weapons if we want to. Our choice of a passive protection goal is of first-rate importance-- if ever nuclear attack is experienced.

This basic tenet is illustrated and applied to the region of San Jose, California, in the series of figures which follows.

The Region around San Jose, California

The "San Francisco and Monterey Bay Areas" within which the City of San Jose is located is shown on the foldout map of Figure 1. The particular portion of this map which will be the focus of much of our attention when planning protection for San Jose has been blocked out in the center. This will be shown in greater detail later in our detailed street map of San Jose. Figure 1 is our regional map.

San Jose can be seen to lie just beyond the south end of San Francisco Bay. It is the dominant city of the area. Major built-up regions on both sides of the bay come together for the first time at San Jose. In general the areas to the east and to the south of San Jose are mountainous and undeveloped. The principal highway/railroad ties to the south are in the southeasterly direction along the axis of the Santa Clara valley.

Prevailing winds are from the northwest. Hence a contaminating nuclear explosion anywhere along the peninsula which lies north of San Jose and to the west of the San Francisco Bay may result in radioactive fallout in San Jose. That peninsula also contains many of the principal assets of the region including the City of San Francisco, the San Francisco Naval Shipyard, the San Francisco International Airport, and a series of suburban communities (the largest of which are San Mateo and Palo Alto). Facilities of NASA and Naval Air are at Moffett Field (just beyond the N.W. corner of the heavy square around San Jose). Moffett Field is the target of a 5 megaton (MT) airburst weapon in the hypothetical first attack specified for the Five-City Study.

On the eastern edge of the bay are additional concentrations of people, industry and special facilities. However, there is no obvious target for enemy destruction within 10 miles of San Jose (to the north). And directly east, south, and southwest the area around San Jose is undeveloped for at least 20 miles. Thus the nuclear threat to San Jose from its surroundings would seem to be predominantly from its upwind neighbors on the peninsula to the northwest. Additionally San Jose, being the third largest city in the San Francisco Bay Area (with more than 300,000 inhabitants) and having light and heavy industry and food processing plants of note, could itself be an enemy target in a large scale or particularized nuclear attack of the United States.

The Possibilities for Protection by Evacuation

As things stand, people in San Jose are threatened by radioactive fallout from contaminating nuclear explosions occurring anywhere in San Francisco or on the San Francisco Peninsula. Persons attempting to evade this threat by moving temporarily out of San Jose would certainly not want to go up either side of the San Francisco Bay since that action would seem to take them into a more dangerous area. Movement to the east is difficult (one low capacity mountainous road), the area is desolate and largely uninhabited, and hazardous fallout from nuclear attacks of the Oakland side of the bay may be encountered. Evacuation southwest, along U.S. Highway 101, tends to be parallel to the wind and so gives little hope of major reductions in fallout over short distances. This leaves only movement (1) into the

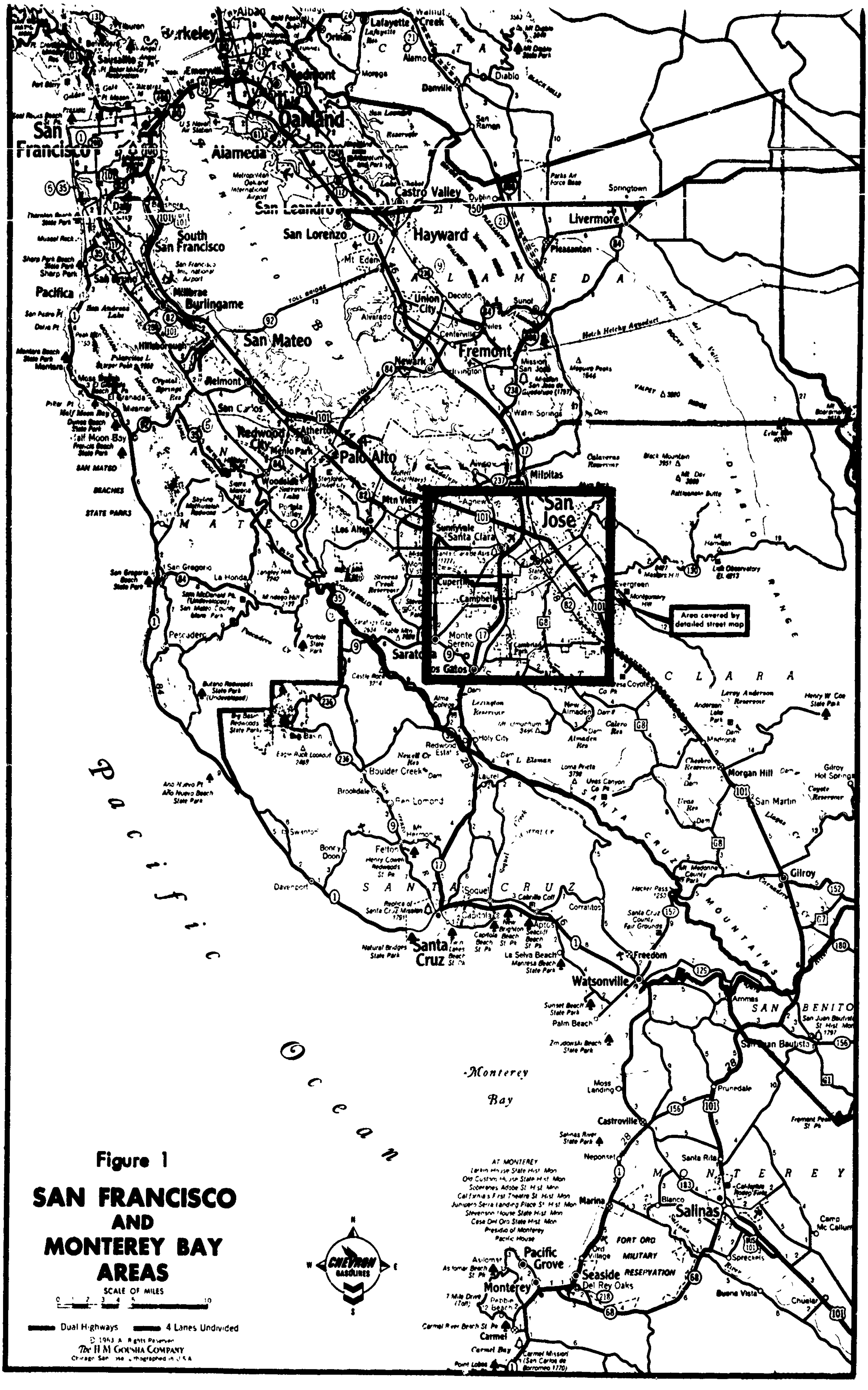


Figure 1

SAN FRANCISCO AND MONTEREY BAY AREAS

largely uninhabited mountains to the west along Highway 9 or (2) over those mountains to the inhabited seashore (to the south) along Highway 17.

Taking the high capacity Highway 17 a distance of about 30 miles to Santa Cruz and the Monterey Bay area (up the coast or down the coast from Santa Cruz) seems to be the best strategy for seeking protection from the effects of nuclear attack in San Jose by evacuation. One would then be at least 20 miles from any obvious possible target of enemy attack, and probably not directly downwind (in the center of the fallout pattern) from nuclear explosions at any distance. As a potential protective measure, evacuation is believed to be important for the people in San Jose, much more important than for many other somewhat similar communities, especially those located in the Eastern United States.

The circumstances that make evacuation favorable for San Jose, include:

1. San Jose is not a high priority (early) target itself.

2. San Jose is not near any obvious high priority target.

3. The possible targets of enemy attack that might lead to fallout in San Jose tend to be in a line generally upwind. Hence the fallout patterns from a number of nuclear explosions on target in the vicinity of San Jose may overlap, producing a narrow region of contamination even from a multiple weapon attack. Moving transverse (across) the dominant wind direction should result in appreciable reductions in gamma-ray intensity when fallout patterns are narrow.

4. There is a high capacity highway from San Jose to Santa Cruz in a direction which cuts across the prevailing wind. This is a popular road, well known to the people of San Jose, and the destination is held in high esteem.

5. Because Santa Cruz and the Monterey Bay area are primarily resort communities, they are not vital targets for enemy destruction and they have housing and feeding capacities beyond the needs of their permanent population (during much of the year).

6. While it is surmised that extensive shelter of high quality probably does not exist around Monterey Bay, the climate there is mild and the use of expedient outdoor shelters in an emergency appears reasonable at any season.

7. The location of Santa Cruz and its neighboring shores on the Pacific Ocean tends to remove the possibility of attacks on targets further west of the San Francisco Peninsula and upwind from the Monterey Bay.

8. Onshore winds at low level and winds from west to east at high level tend to characterize this region, allowing one to generally ignore possible targets of enemy attack which are inland.

9. In the event of enemy attack, much of the Pacific Ocean coast of the United States has been predicted by previous analysts to receive little or no fallout. Santa Cruz and vicinity is among such regions.

While the problem of providing area-wide shelter systems cannot be solved by evacuation, the prospects for evacuation must be included in any serious evaluation of the gamut of protection possibilities for a given community. For San Jose, the possibilities of evacuation being successful, if evacuation is possible at

all,* are rated very good—on the basis of a first crude look at the characteristics of its surroundings. No actual plan for evacuating San Jose has been discovered, and none has been made by this study. These first considerations will be our only treatment of evacuation. Evacuation as a protection probability must necessarily be included in our future lists of countermeasures to nuclear attack; the brief treatment given here is intended to show what we mean by evacuation, when that term is applied to San Jose.

Influence of Shelter Characteristics on the Effective Size of Enemy Weapons

Since shelters are the essence of area-wide shelter systems, it is pertinent to appreciate their potential for saving life. One way to get at this is to show the area of widespread death associated (for the purpose of planning protection) with a particular shelter/weapon combination. The larger the enemy weapon, the larger the area of widespread death; the better the shelter, the smaller the area of widespread death. To represent such areas in meaningful terms we will sketch them at the scale of our regional foldout map of Figure 1 (which should now be left folded out and continuously visible at the left).

* See reports of the Hudson Institute for arguments that conspicuous international tension (providing "opportunity" for evacuation) is likely to precede nuclear attack, e.g. William M. Brown, A New Look at the Design of Low-Budget Civil Defense Systems, Hudson Institute report HI-478-RR for the Office of Civil Defense, August 2, 1965.

Our purpose being the protection of people, we will assume the enemy's use of that type of nuclear explosion expected to be most effective against people: the fallout-producing surface-burst. The sizes of enemy weapons postulated will generally be 0.1 megatons (MT), 1.0 MT, and 10 MT. For reference purposes we will also show 100 MT (in subdued form) even though such a weapon has been judged unreasonably large for attack purposes. According to Strope and Christian:*

> "For the present and the near future, weapons of yields up to about 20 MT are considered feasible as offensive weapons against this country. Weapons of 100 MT or greater are not considered a significant threat, not only from the standpoint of efficiency of use but also largely because of the problems of delivery to the target."

To get under way, however, we will use a 15 MT nuclear explosion (on the earth's surface) because of the ready availability of a pattern representing the estimated dose from the radioactive fallout from such a weapon. Data from the U.S. nuclear weapons test CASTLE BRAVO were used to generate the fallout pattern shown in Figure 2.** While the test measurements of gamma radiation from that explosion were rather sparse (only occasional islands and ships could be used for

* Walmer E. Strope and John F. Christian, Fire Aspects of Civil Defense, Research Report No. 9, Office of Civil Defense, May 1964, p. 1.

** Taken from Samuel Glasstone, The Effects of Nuclear Weapons, U.S. Government Printing Office, 1964, p. 462.

the determinations), we were attracted to Figure 2 because it is based fairly directly on actual measurements. Figure 2 also shows the circles where various peak blast overpressures are to be expected under idealized conditions. These are according to the "Nuclear Bomb Effects Computer" which accompanies The Effects of Nuclear Weapons (1964).

"Widespread death" is taken to be where some 20-25% of those exposed die. Estimates for deaths from gamma-radiation are given in Table 1. Since the gamma-ray dose estimates of Figure 2 are for 96 hours or 4 days, we conclude from Table 1 that something like 400-500 Roentgens (R) would be appropriate as the value for 20-25% mortality for the fallout pattern of Figure 2. (The effects of the gamma-ray dose obtained after 4 days are believed to be relatively inconsequential, if everything remains the same, and no repeat attacks occur.)

In the vicinity of ground zero, of course, there may be deaths from causes other than fallout gamma radiation. The direct effects of nuclear explosions which tend to have the greatest lethal range are (1) skin burns from direct exposure to the fireball and (2) post-attack fires in built-up areas which drive people out of shelter into open incombustible areas where they are fully exposed to fallout. In clear weather, skin burns of sufficient intensity to cause death if large areas of the body are involved may extend as far as the 1 psi peak overpressure. For protection planning we assume deaths from direct effects may extend (under favorable conditions) as far as 1 psi blast--this is taken as the maximum value. And if weather and target conditions are suitable the post-attack fire may start or spread nearly as far (leaving escapees subject to radioactive fallout).

Table 1

ESTIMATED MEDICAL EFFECTS OF RADIATION DOSES EXPRESSED AS PROBABILITY OF SICKNESS OR DEATH

Early Effects for Periods of Time Over Which Total Dose is Received

Measured Dose (R)	1 Day		3 Days		1 Week		1 Month		3 Months or more		Significant Late Effect
	Sickness	Death	Sickness	Death	Sickness	Death	Sickness	Death	Sickness	Death	
0 to 75	0%	0%	0	0	0	0	0	0	0	0	None
100	2%	0%	0	0	0	0	0	0	0	0	None
125	15%	0%	2%	0%	0	0	0	0	0	0	None
150	25%	0%	10%	0%	2%	0%	0	0	0	0	None
200	50%	0%	25%	0%	15%	0%	2%	0%	0%	0%	Some
300	100%	20%	60%	5%	40%	0%	15%	0%	0%	0%	Some
450	100%	50%	100%	25%	90%	15%	50%	0%	5%	0%	Some
650	100%	95%	100%	90%	100%	40%	80%	[illegible]	10%	9%	Some

This table applies to healthy, young adults under usual working conditions. The probability of fatalities will be decreased with adequate medical treatment.

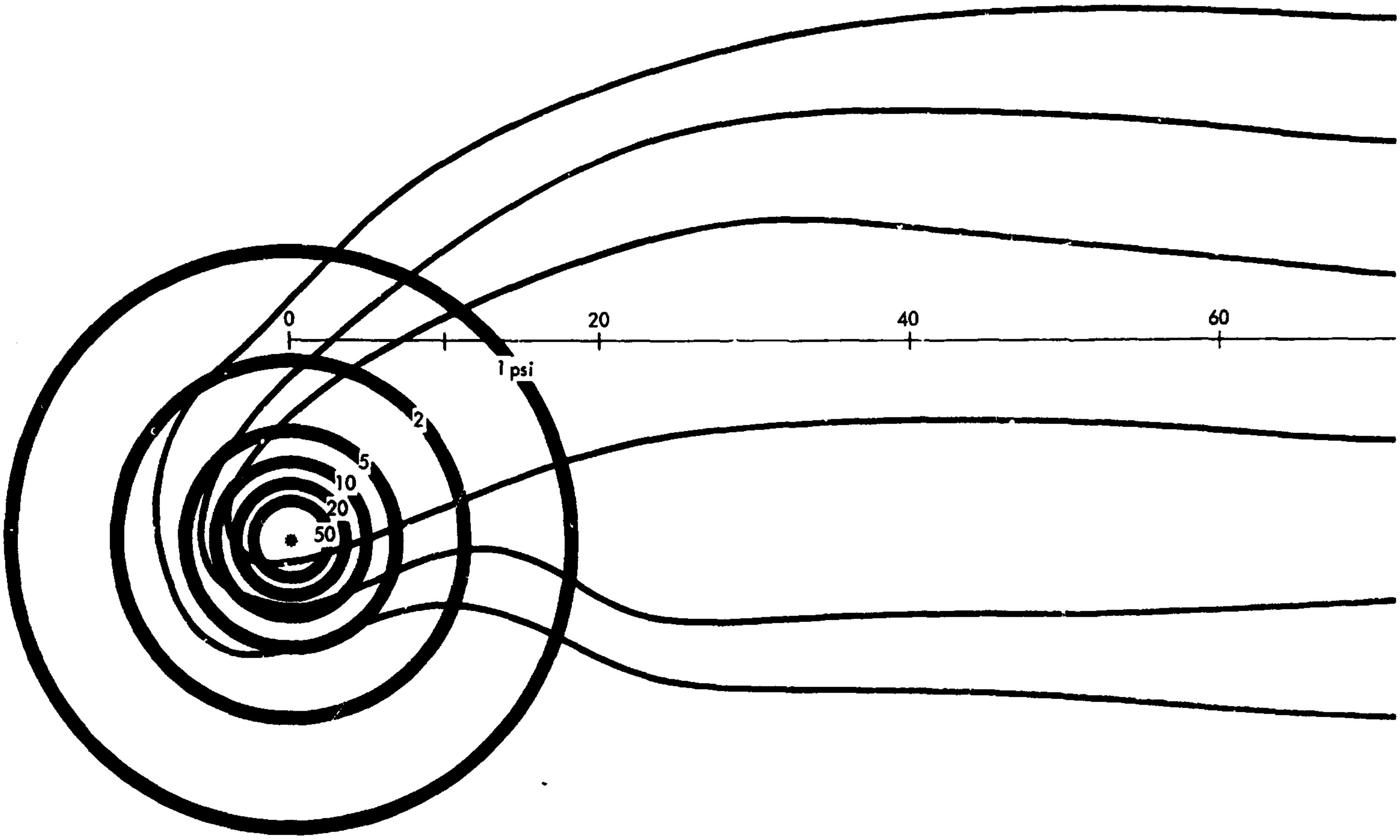
Measured doses related to the underlined zero percentage value for each stay-period are recommended as general use criteria.

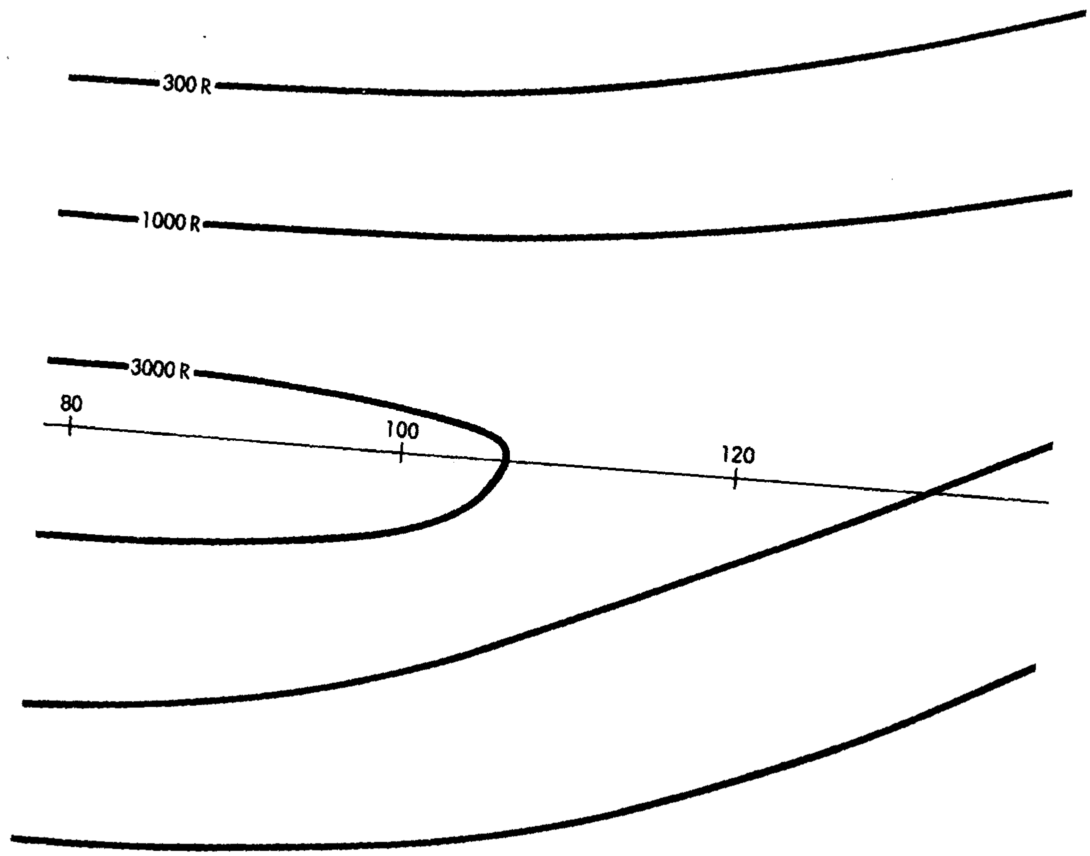
SOURCE: Design of Structures to Resist Nuclear Weapons Effects, American Society of Civil Engineers, Manual of Engineering Practice No. 42, 1961, p. 27.

Figure 2

ESTIMATED PEAK BLAST OVERPRESSURES AND FOUR-DAY GAMMA-RAY DOSE CONTOURS FROM 15 MT SURFACE BURST--CASTLE BRAVO TEST EXPLOSION

SCALE: Same as Figure 1





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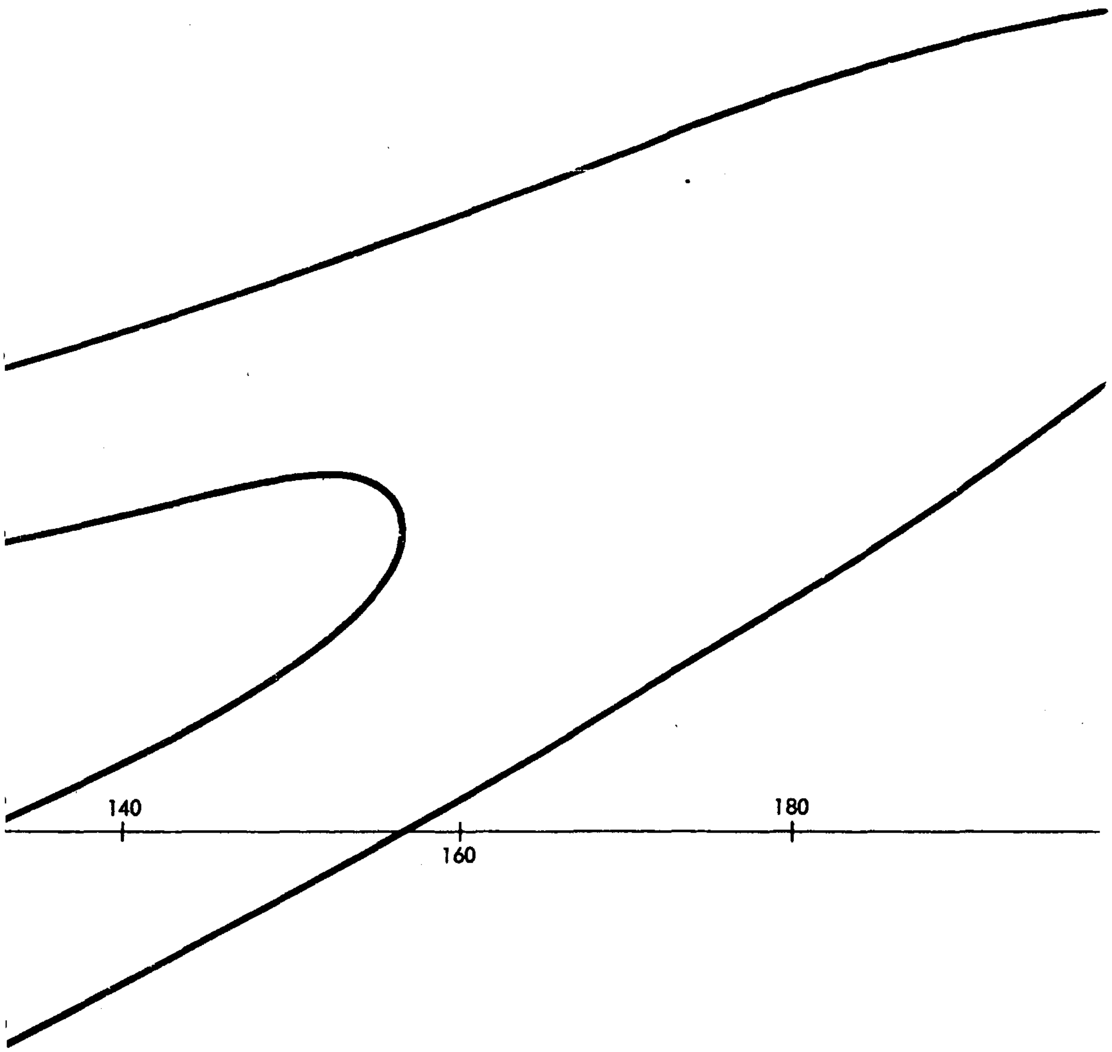

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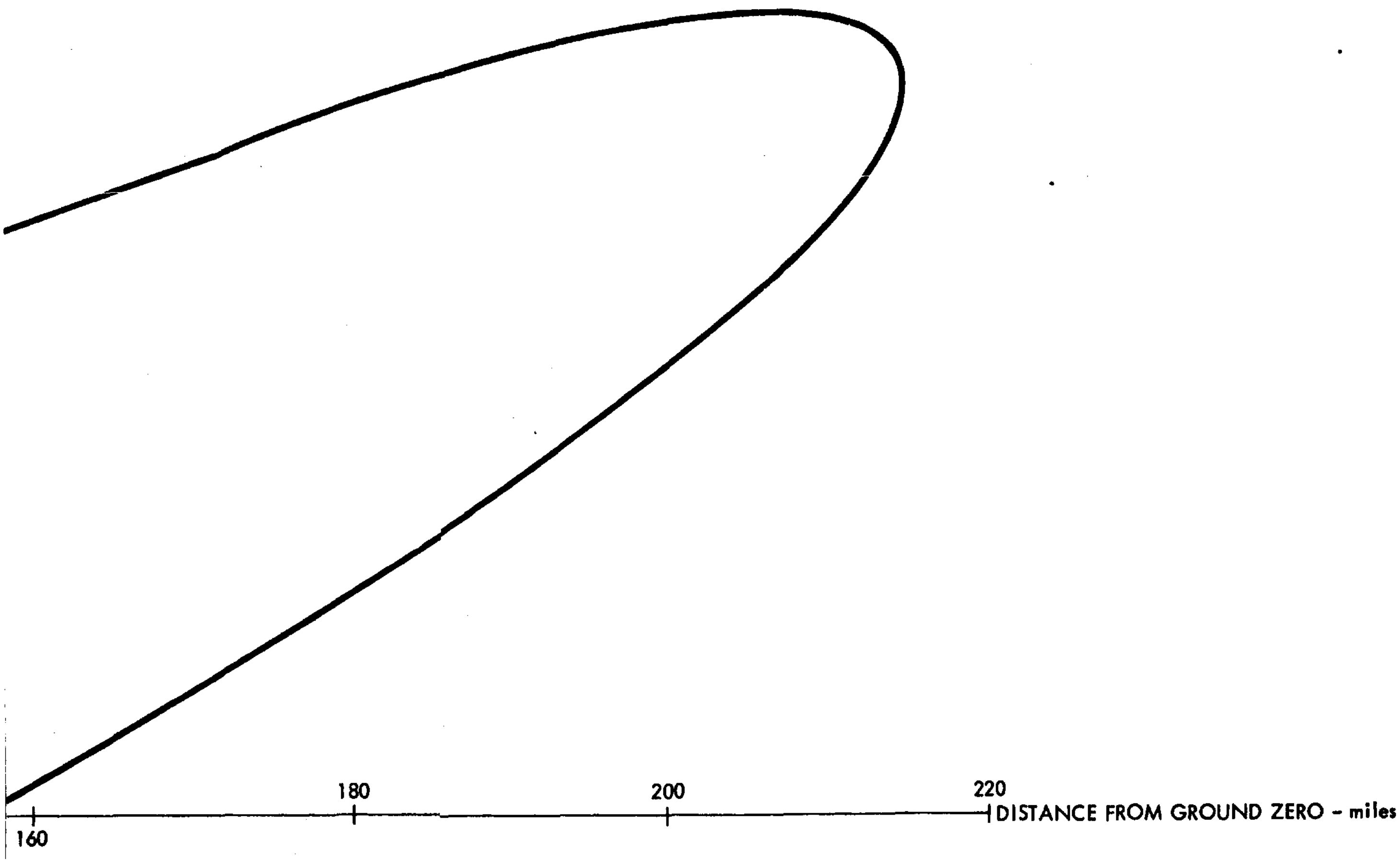

180
200
220
DISTANCE FROM GROUND ZERO - miles
160

in fallout shelters until the gamma radiation outside decays to an acceptable level.

With complete fallout protection, people are assumed to be in fallout shelters before the nuclear explosion occurs, hence they are not exposed to the heat and light from the fireball (capable of causing lethal skin burns), even in the vicinity of the explosion. But as one closes in on ground zero one encounters the outer fringe of the mass fire expected to consume the combustible parts of most U.S. communities (as presently built). Here is where protection--as intended by the complete fallout shelter program--first proves inadequate. Because of fires resulting from primary (fireball-induced) and secondary (blast-induced) causes, people will tend to be driven out of some fallout shelters--as presently constituted--by the noxious products of combustion. Fallout shelters in ordinary buildings (as identified by the National Fallout Shelter Survey) may be subject to mass fire, and such fires seem likely to extend at least to the 2 psi (minimum) and occasionally to the 1 psi (maximum) peak blast levels. Thus even with plenty of shelters, if those shelters cannot exclude fire and its combustion products, the occupants thereof may be forced out into the fallout by fire effects. Hence death from fallout may threaten people in identified shelters out to at least 2 psi, and perhaps as far as 1 psi in some cases.

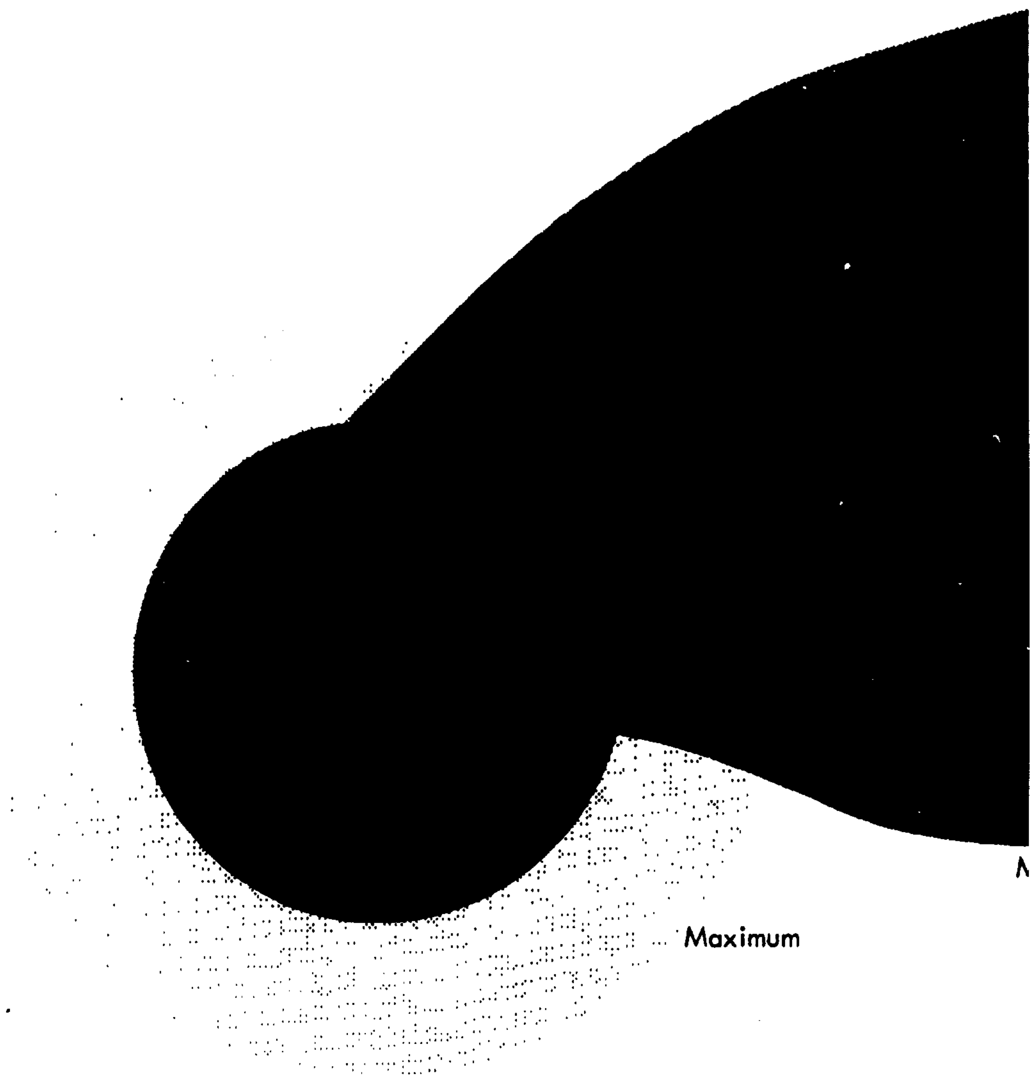
* This concept is also official OCD policy, being included in the "Fiscal Year 1966 Program Emphasis" of the Federal Civil Defense Guide, April 1965, Part B, Chap. 3, App. 1, p. 1, as follows:

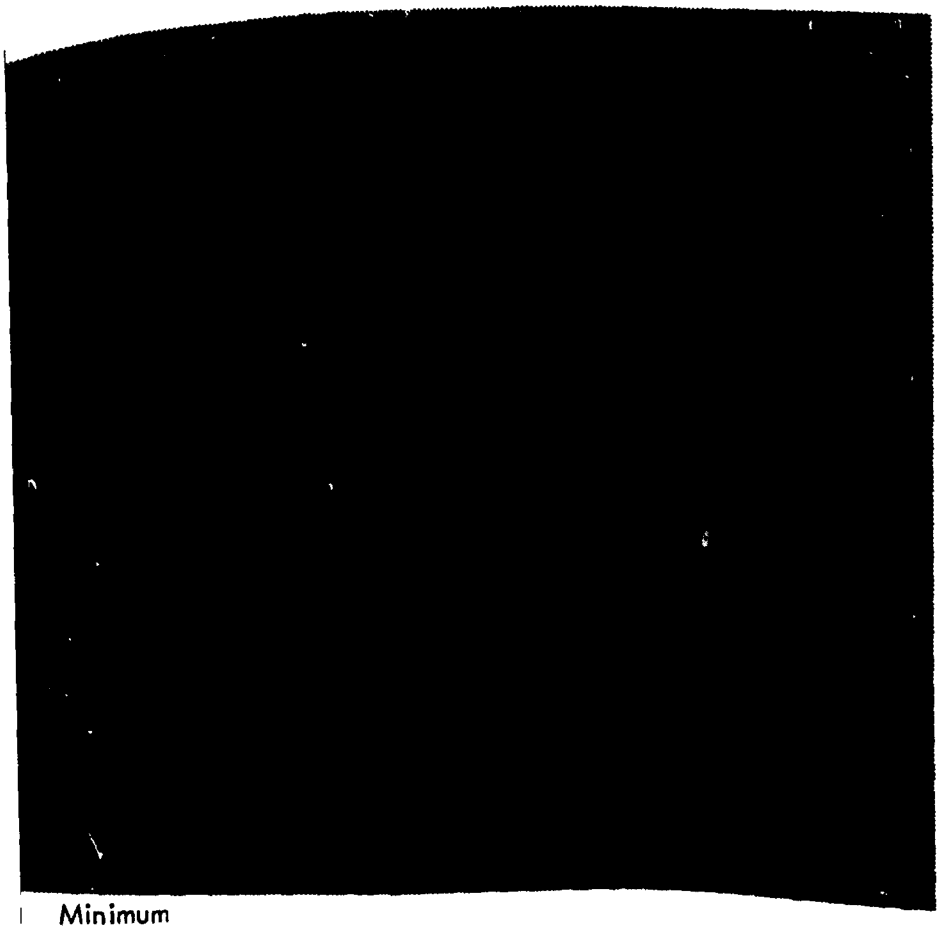
"Community Shelter Planning and action... should be based on making the most effective use of the best protection available. This may include, as a temporary measure, some use of facilities with PFs under 40 or capacities under 50, space allowances of less than 10 square feet per person, times for movement to shelter greater than 30 minutes in urban or suburban areas or 60 minutes in rural areas, or the use of home basements where possible and where no other alternative is now available."

Figure 3

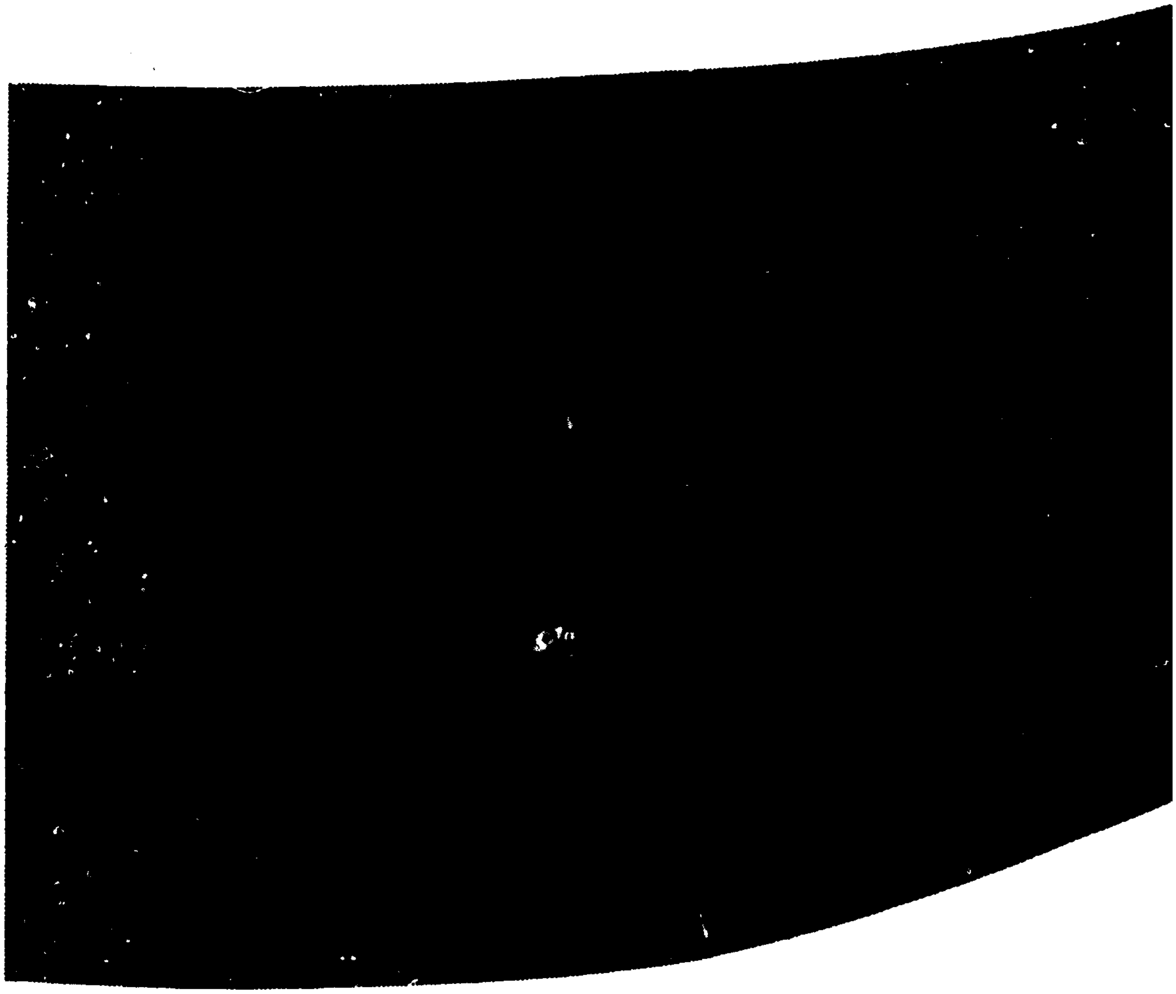
AREA OF 20-25% MORTALITY--NO FALLOUT PROTECTION
PEOPLE TOTALLY EXPOSED IN THE OPEN
15 MT SURFACE BURST

SCALE: Same as Figure 1





Minimum



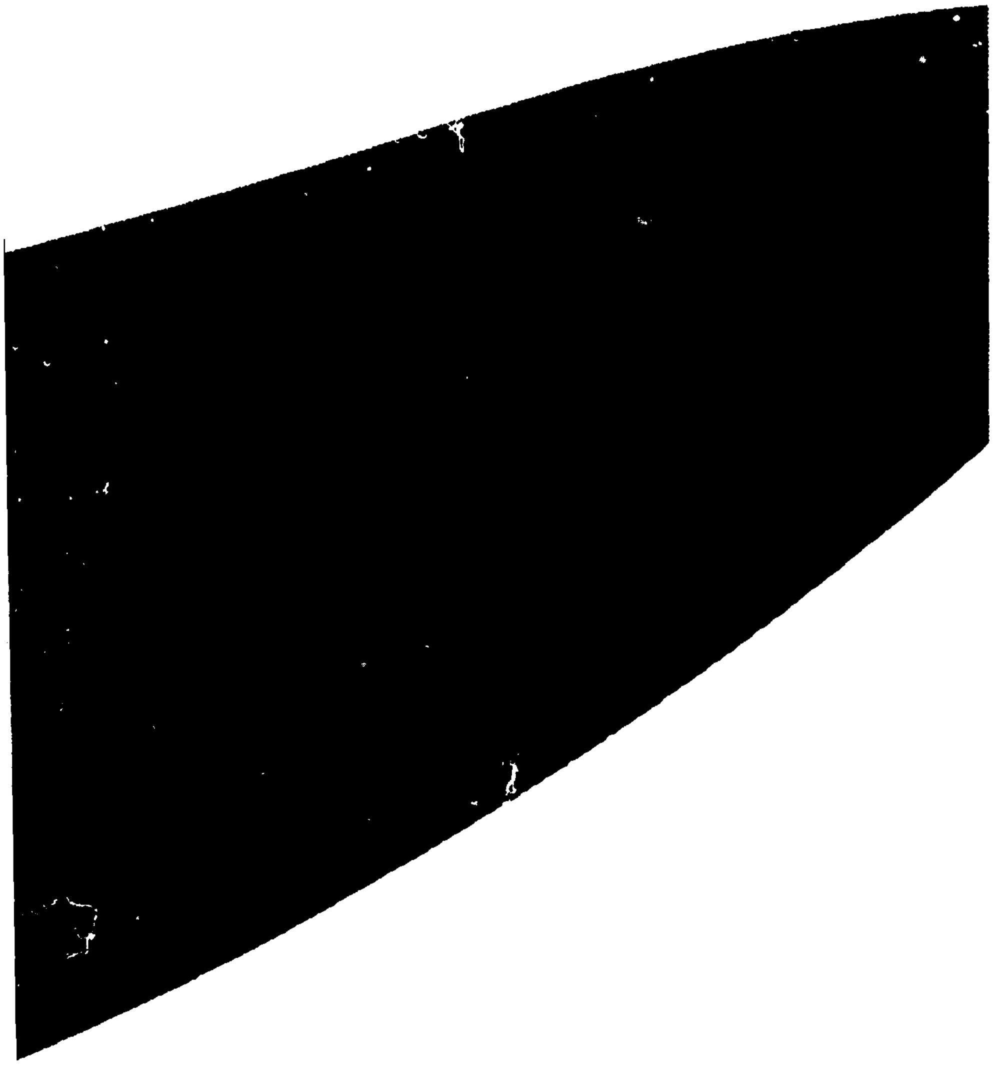
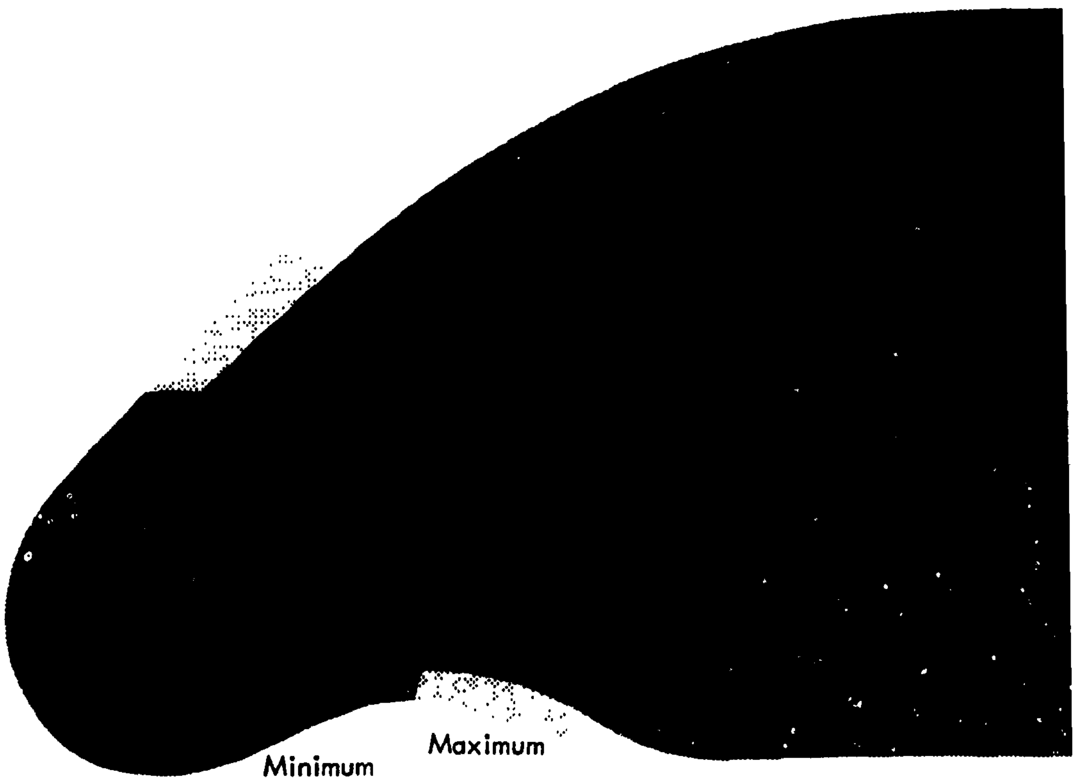
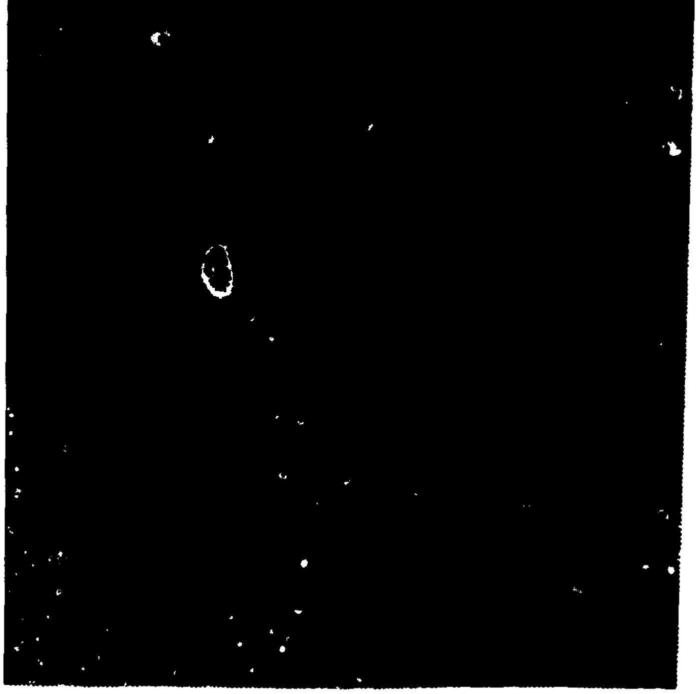


Figure 4

AREA OF 20-25% MORTALITY--PROTECTION FACTOR 2
PEOPLE INDOORS IN LIGHT-FRAME DWELLINGS
15 MT SURFACE BURST

SCALE: Same as Figure 1





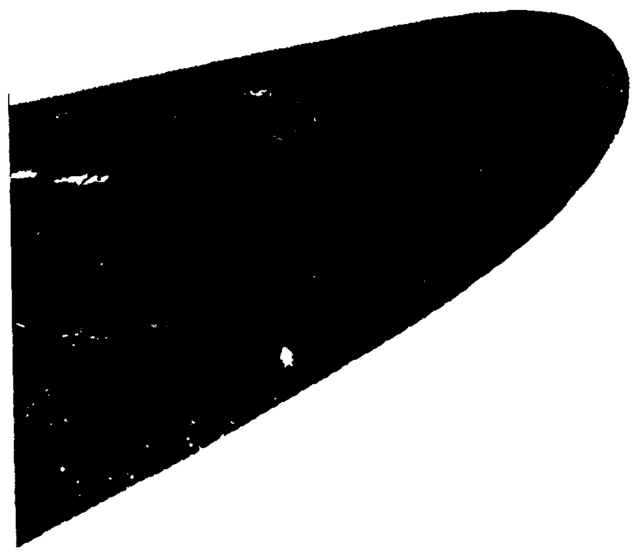
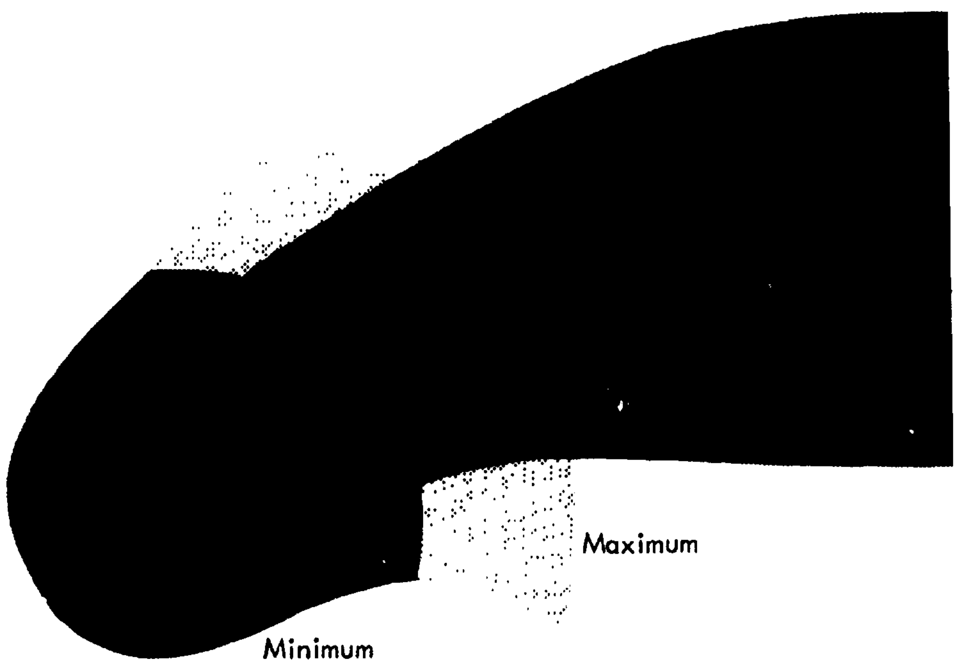
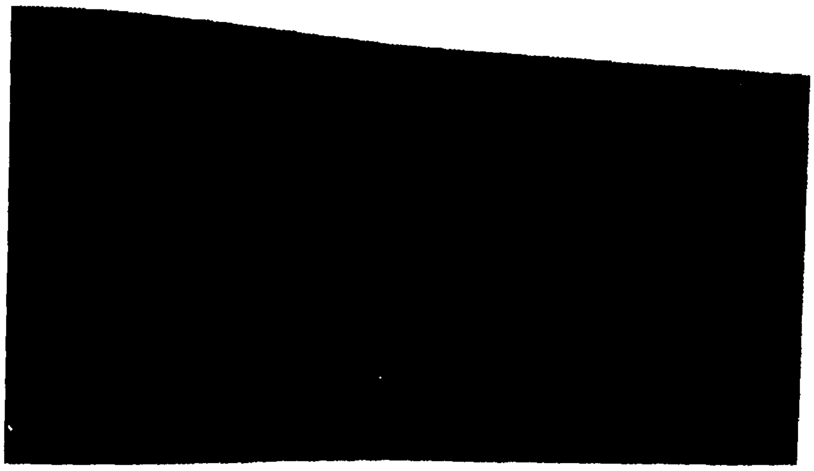


Figure 5

AREA OF 20-25% MORTALITY--PROTECTION FACTOR 5
15 MT SURFACE BURST

SCALE: Same as Figure 1





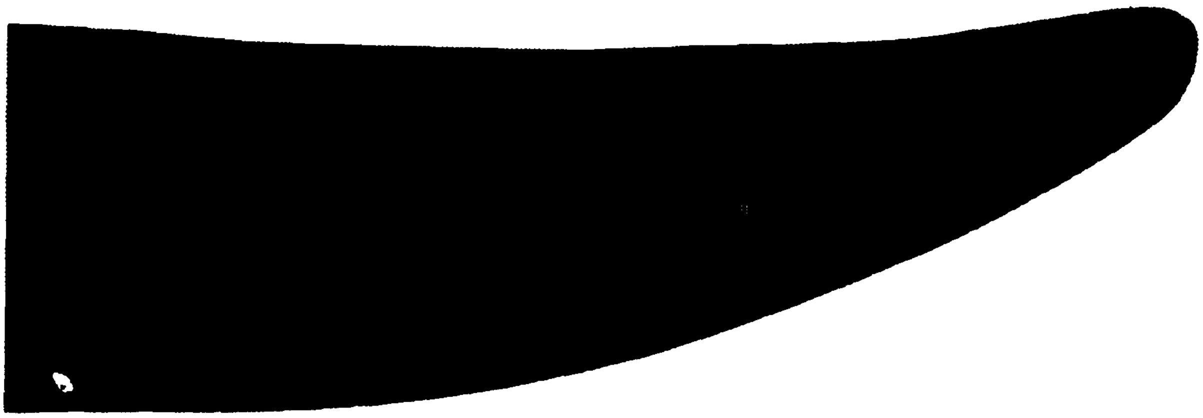
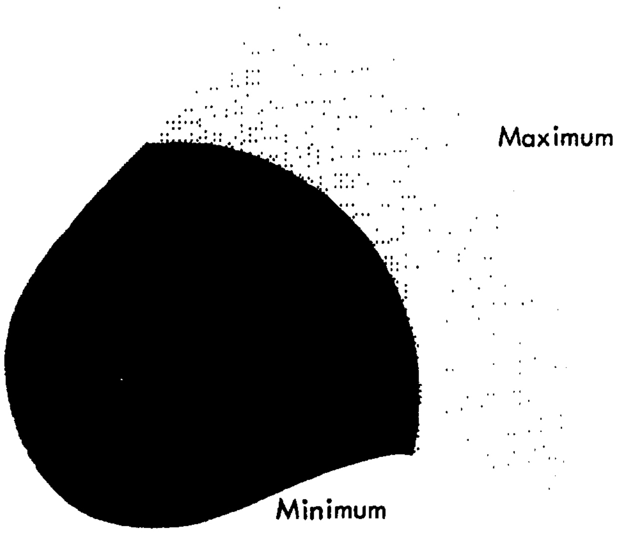


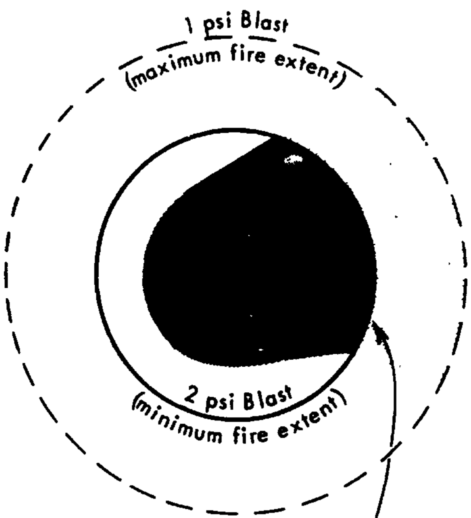
Figure 6

AREA OF 20-25% MORTALITY--PROTECTION FACTOR ≥ 10
PEOPLE IN HOME BASEMENTS OR BETTER SHELTER
15 MT SURFACE BURST

SCALE: Same as Figure 1



Based on the relations between the fallout pattern and the blast circles of the 15 MT explosion of Figure 2, it is evident that the lethal fallout does not extend as far as 2 psi in all directions. Rather is this hazard localized to the downwind portion of the 2 psi (and 1 psi) circles. Thus the area of 20-25% mortality of Figure 6 (facing) extends as far as 2 psi (or 1 psi) peak overpressure in the direction of the wind. To the sides and upwind, for that particular weapon, the "contour of lethal fallout" is within the 2 psi circle. The following sketch illustrates these relations.



Area of 20-25% Mortality from Fallout with PF = 10
(People denied shelter by fire effects)

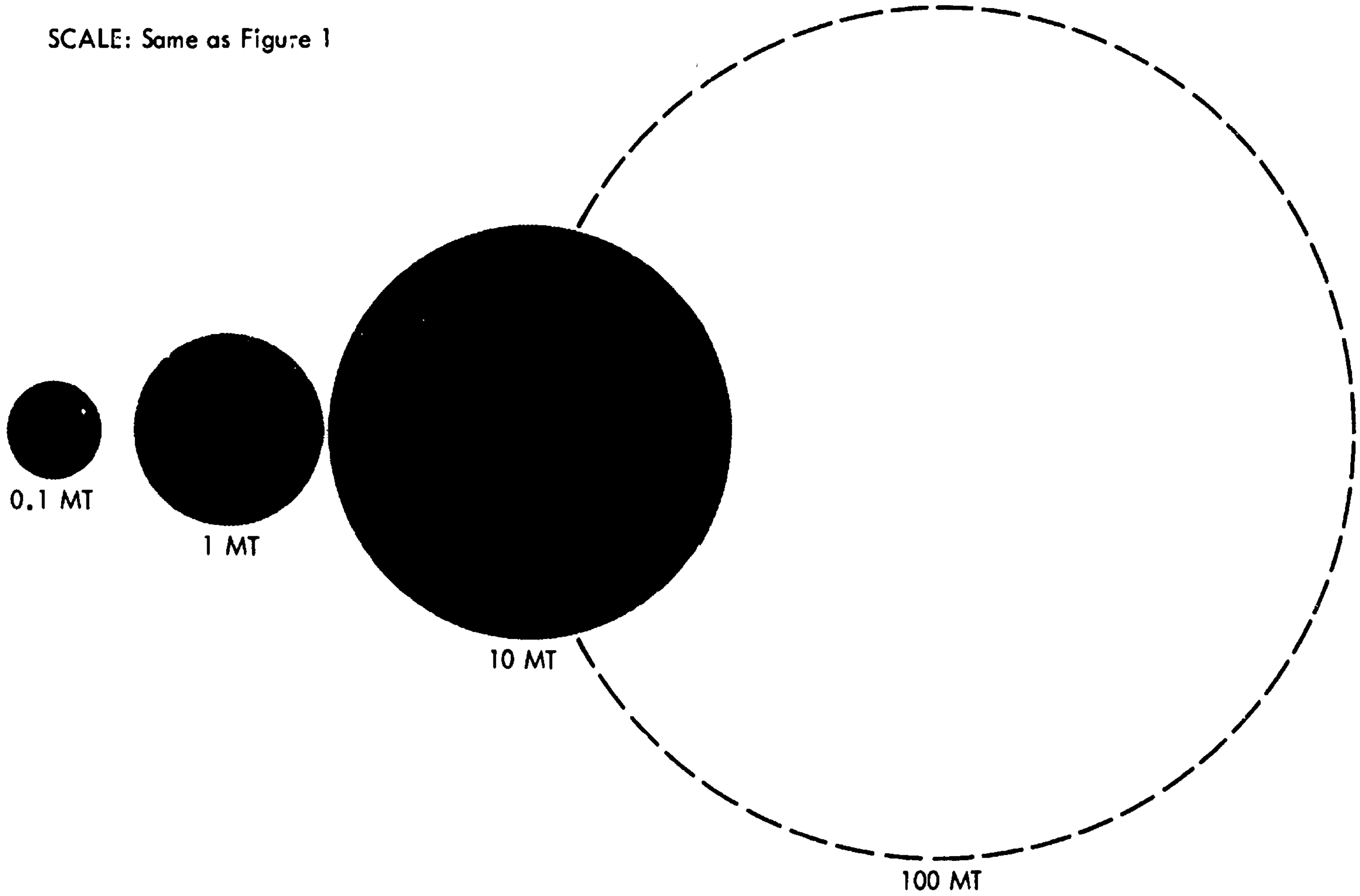
If the mass fire extends no farther than 2 psi, the area of 20-25% mortality would be <u>less</u> than the area of the 2 psi blast circle. If the mass fire extends as far as 1 psi (through long range ignitions or appreciable fire spread), the area of 20-25% mortality could be more than the area of the 2 psi blast circle. Thus the area of the 2 psi blast circle may be in between the minimum and maximum areas of 20-25% mortality shown above. For simplicity we will represent this range of possible "areas of widespread death" by the intermediate approximation of the area defined by 2 psi. While this approximate equivalence has been shown for just one fallout pattern (CASTLE BRAVO) and one weapon size (15 MT), we will assume it appropriate also for other weapon sizes (from 0.1 MT to 100 MT) and weather conditions. This assumption is equivalent to saying that <u>there is a serious danger of death from fallout wherever people are driven out of shelter</u> by the direct effects of a nuclear explosion.

While the above assumption may not be strictly accurate for particular weapon/weather combinations when considering a single nuclear explosion (as we have been doing), if one thinks of the widespread contamination which may result from a large scale attack of the United States with many weapons, such deviations from reality appear unimportant for protection planning. If fallout shelters are generally needed in case of nuclear attack, that need is no less in the vicinity of nuclear explosions. Hence the assumption that people driven out of shelter by fire or blast effects (in the absence of alternate shelter) face death from fallout is be-

Figure 7

AREAS OF 20-25% MORTALITY--COMPLETE FALLOUT PROTECTION
PEOPLE IN SHELTERS VULNERABLE TO MASS FIRE EFFECTS
SURFACE BURSTS OF VARIOUS YIELDS

SCALE: Same as Figure 1



This will be the general character of the existing fallout shelters identified in ordinary buildings by the National Fallout Shelter Survey (NFSS).

lieved to be valid, and will be the basis of the direct-effects analysis which follows.

We consider second, then, the areas of 20-25% mortality (on the same scale as the foldout regional map of San Jose, Figure 1) after complete fallout protection has been provided, assuming various fire and blast resistances for the shelters involved and looking at the range of weapon sizes: 0.1 MT, 1 MT, 10 MT and 100 MT. The thing to notice, of course, is how the apparent size of the weapon is reduced as the protection provided by shelter is improved. The schedule of Figures is:

Shelter Characteristics

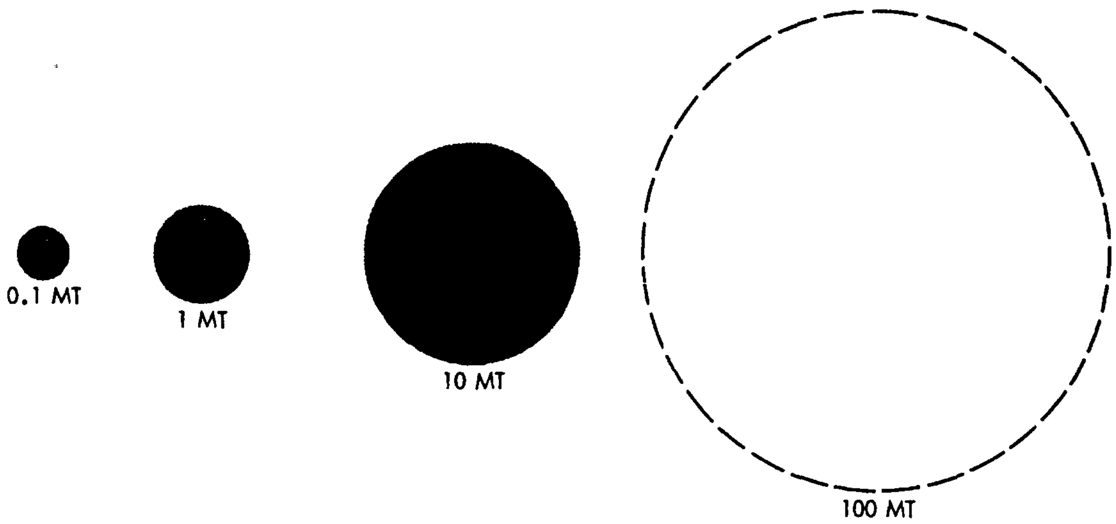
Figure	Fallout Protection	Fire Protection	Blast Resistance	Rough Estimate of Casualties in Overstressed Shelters
7	Complete	Ordinary Construction		20-25% mortality at 2 psi
8	"	Complete	2 psi	" " " 5 psi
9	"	"	5 psi	" " " 10 psi
10	"	"	10 psi	" " " 20 psi
11	"	"	30 psi	" " " 50 psi

People are assumed to be in shelter prior to local attack. The cause of death with the greatest range for shelters of ordinary construction (public shelters identified by National Fallout Shelter Survey) is fallout, for people forced out of shelter by fire and combustion products (Figure 7). For the more resistant shelters of Figures 8-11 the causes of death with the greatest range are mechanical injury from blast effects, trapping and fire effects, and radioactive fallout. Here again people may be driven out of shelter by fire (in built-up areas), by shelter collapse (from blast), and by combinations thereof.

Figure 8

AREAS OF 20-25% MORTALITY--COMPLETE FALLOUT PROTECTION
PEOPLE IN SHELTERS UPGRADED AGAINST FIRE/BLAST TO 2 PSI
SURFACE BURSTS OF VARIOUS YIELDS

SCALE: Same as Figure 1



These two pages show the approximate direct-effects protection which can probably be obtained in selected reinforced-concrete basement shelters in existing ordinary buildings (as identified by the NFSS) after upgrading by low-cost methods and if satisfactory procedures for providing breathable air for shelterees in spaces vented by blast can be developed.

Figure 8 presumes little or no strengthening of the basement structure. Figure 9 may require that special internal supports be added within the basement to increase its resistance to collapse under blast loading.

Figure 9

AREAS OF 20-25% MORTALITY--COMPLETE FALLOUT PROTECTION
PEOPLE IN SHELTERS UPGRADED AGAINST FIRE/BLAST TO 5 PSI
SURFACE BURSTS OF VARIOUS YIELDS

SCALE: Same as Figure 1

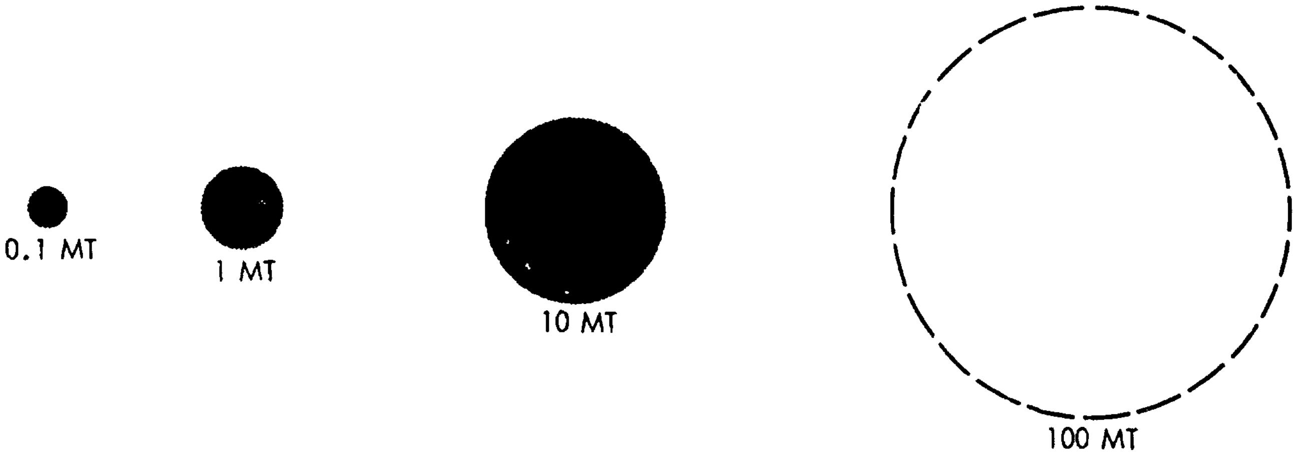
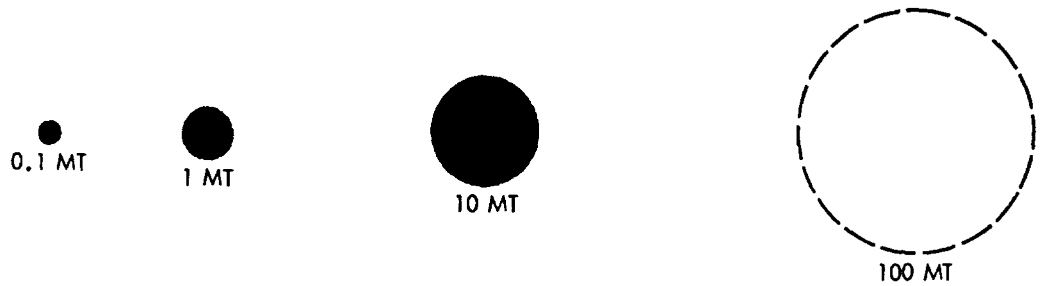


Figure 10

AREAS OF 20-25% MORTALITY--COMPLETE FALLOUT PROTECTION
PEOPLE IN SPECIALLY CONSTRUCTED BLAST SHELTERS GOOD FOR 10 PSI
SURFACE BURSTS OF VARIOUS YIELDS

SCALE: Same as Figure 1

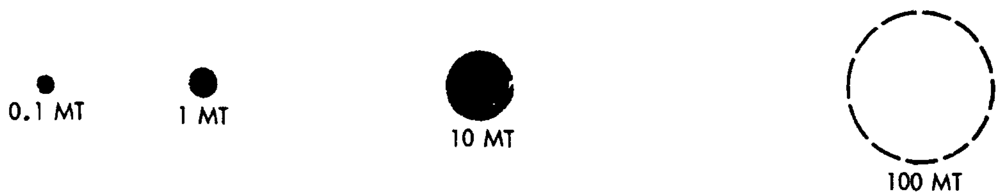


The protection shown in these two figures is generally expected to be beyond that which can be provided by the low-cost upgrading of the very best of the NFSS (basement) shelters in ordinary buildings within built-up areas. These levels of protection usually require the new construction of structures specifically for shelter purposes.

Figure 11

AREAS OF 20-25% MORTALITY--COMPLETE FALLOUT PROTECTION
PEOPLE IN SPECIALLY CONSTRUCTED BLAST SHELTERS GOOD FOR 30 PSI
SURFACE BURSTS OF VARIOUS YIELDS

SCALE: Same as Figure 1



This is believed to be a good nominal value for planning purposes for blast shelters for Direct-Effects Regions. Higher values are of course feasible at the price of greater cost and elaborateness.

Assuming fallout shelters for everyone, it is instructive to compare the areas of 20-25% mortality for 1 MT and 10 MT with the fallout regional map of Figure 1 when the fallout shelters have a blast and fire resistance for 30 psi (Figure 11), for 2 psi (Figure 8), and are without special fire resistance (Figure 7). Clearly passive protection can cut the effective size of enemy weapons way down! And if one goes further back and reconsiders the areas of 20-25% mortality of Figures 5, 4 and 3, it is obvious that passive protection can reduce enormously the population loss from contaminating nuclear attack. The indicated reductions, while only approximate, would be little affected by a more accurate (and labored) treatment. There is great potential in passive protection. It appears well worth having at almost any level that is significantly more protective than the status quo. One can proceed to save lives by taking one big leap in protection, or through many small improvements.

III OUTLINE OF PROTECTION PLANNING AT THE LOCAL LEVEL

In this chapter we attempt to outline the principal features of planning passive protection at the local level--as required for area-wide shelter systems. Those features are listed below, and will be considered in the order shown. To introduce all entries in that list in a reasonable number of pages, the treatment of each has been limited in this chapter to 2 pages. Where additional information is required it is given in later chapters. Page references to those later, more detailed, presentations are given in the margins of this chapter. Thus this chapter is intended to serve a dual purpose: to give an overall view of the total protection planning process, and to introduce particular individual topics examined in greater depth subsequently.

1. Purpose of Protection.
2. Categories of Nuclear Weapons Effects for Planning Protection.
3. Basic Principles of Passive Protection by Regional Category.
4. Potential Elements of Passive Protection.
5. Rating Different Physical Protection.
6. Factors Affecting the Local Approach to Passive Protection.
7. Planning the Physical Protection to Use for Area-Wide Shelter Systems.
8. Evaluating Area-Wide Shelter Systems.
9. Support Systems for Area-Wide Shelter Systems.
10. Readiness for Area-Wide Shelter Systems.
11. Attitude and Support for Civil Defense.
12. How Organizations and Families Can Improve Their Protection.
13. Composite Systems of Protection.
14. Specific Objectives for Composite Systems of Protection.
15. Plans for Execution of Selected Programs for Protection.
16. Review and Updating of Protection Planning.

1. Purpose of Protection

To preserve people from the effects of nuclear attacks of the United States; to provide the post-attack period with able survivors.

2. Categories of Nuclear Weapons Effects for Planning Protection

- Very severe direct effects (> 50 psi peak overpressure) and fallout.
  As may occur near a hard-point or small-area target.
  This defines a **TARGET REGION.**
  Example: Moffett Field, California--Naval Air Station and NASA Research Center, near San Jose.

- Direct effects ($\leq$ 50 psi peak overpressure) and radioactive fallout.
  As may accompany the attack of a soft large-area target, or within 20 miles of an enemy target (but outside the Target Region).
  This defines a **DIRECT-EFFECTS REGION.**
  Example: San Jose, California, population > 300,000.

- Radioactive fallout only.
  More than 20 miles from any enemy target.
  This defines a **FALLOUT-ONLY REGION.**
  Example: San Jose (Fallout Only)

* A contingency measure, in case time allows, requiring evacuation preattack to another locality having a larger ratio of $\frac{\text{protection}}{\text{threat}}$ in available shelter or expedient shielding.

** A contingency measure, in case time allows, wherein some people transfer their activities preattack to places within the same locality but closer to shelter.

*** See for example: John L. Crain and Charles D. Bigelow, Civil Defense Rescue Requirements Following a Nuclear Attack, Stanford Research Institute for the Office of Civil Defense, February 1965.

3. Basic Principles of Passive Protection by Regional Category

TARGET REGION (e.g. Moffett Field)

Evacuate,* relocate,** or take shelter locally in specially hardened blast shelters.

This case not treated further in this study.

DIRECT-EFFECTS REGION (e.g. San Jose (Direct Effects))

Evacuate,* relocate,** or take shelter locally. Local shelter and support systems have substantial protection against direct effects and radioactive fallout.

"Ideal Blast Protection" would be everyone in shelter (prior to attack) that was fire- and fume-proof, blast resistant to about 30 psi or more, and with a protection factor of at least 500-1000.

On the way to "Ideal Blast Protection" there is interim interest in protection with improved resistance to fires and fumes, blast resistance from 2 to 5 to 10 to 30 psi, and protection factors from 10 to 1000.

"Ideal Blast Protection" would protect people continuously in their original shelter--1 stage (static) protection. Prior to that realization, other procedures may be necessary which involve 2 or even 3 stages--dynamic protection, where people move from one protective physical facility to another as required by circumstances (since no one of the available protective facilities will protect against all applicable nuclear weapons effects). An important form of two-stage protection is presently (1) the NFSS reinforced-concrete basement shelter in a built-up community for initial protection from blast; then its occupants driven out of shelter (following the blast) by the postattack fire and fumes, and escaping to (2) the interiors of large open incombustible areas within the community. If, after the fire burned itself out, some people returned to (3) the remaining basement shelters--still habitable and protective--that move would be a third stage.

FALLOUT-ONLY REGION (e.g. San Jose (Fallout Only))

Evacuate, relocate, or take shelter locally. Local shelter and support systems protective against radioactive fallout.

"Complete Fallout Protection" would be everyone in fallout shelter (before fallout arrives) with a protection factor of at least 40-100.

On the way to "Complete Fallout Protection" there is interim interest in shelters and shielding with protection factors from 10 to 100.

One-stage protection has been the usual concept for countermeasures against radioactive fallout, although procedures for remedial movement of shelterees from high radiation fields (in shelter) to lower radiation fields have been suggested by others.*** Here we will contemplate only the simple one-stage (static) protection against fallout.

See facing page for footnotes.

4. Potential Elements of Passive Protection

Passive protection depends on three different kinds of things: Facilities, Readiness, and Attitude and Support for Civil Defense. These can be subdivided as follows to reveal the essential elements.

FACILITIES	
Physical Protection	**Inanimate materials needed for protection against nuclear weapons effects: strength against blast, no fire in shelter and fire fumes excluded, massive absorbers of gamma radiation. (Includes adjuncts for direct effects, aids for decontamination, and items to make the protective spaces habitable.)**
Shelters	**Protective spaces in buildings or their equivalent. Normal buildings (and NFSS shelters) are vulnerable to blast and fire. Additionally the shelterees are vulnerable to fire fumes and fallout gamma-radiation.**
Shielding	**Protective spaces outdoors, not in normal buildings.**
Large Open Incombustible Areas (within the community)	**Interiors useful to escape large-scale community fires in built-up areas. Examples are large school grounds and sizeable parks without too many trees or shrubs.**
Support Systems	The additional physical materials normally required to make shelter work. Must be protected from nuclear weapons effects so they can function postattack as required. Chiefly for pertinent information and enlightened guidance.
Communications	The means for getting and giving information critical to the emergency.
Warning	The means for notifying people to get into their physical protection; also needed for getting people out of their "protection" when necessary.
Radiological Defense (RADEF)	The arrangements for determining the operational implications of the radioactive fallout received locally.
Emergency Direction and Control	The arrangement provided for a community command post to facilitate emergency operations and protection of the public.
READINESS	
Operators	The trained personnel necessary to run the civil defense program and the protective facilities mentioned above.
Occupants	Preparations of the public to be ready for nuclear emergencies. Public readiness interacts with warning and communications so that with greater readiness there is a lesser requirement for detailed information. Preparing the public may also serve to heighten the interest in civil defense.
ATTITUDE AND SUPPORT	
Key Individuals Influential Organizations General Public	The targets of programs intended to gain support for the valid civil defense that exists, and build demand for more and better civil defense. Each of the three categories shown is believed to be important.

PHYSICAL PROTECTION FOR DIRECT-EFFECTS REGIONS	PHYSICAL PROTECTION FOR FALLOUT-ONLY REGIONS	CONSIDERED FURTHER ON PAGE
New Blast Shelters (blast hazard to 20-50 psi)		100
New Limited-Blast Shelters (blast hazard to 10 psi)	New Limited-Blast Shelters (PF ≥ 100)	98
	New Buildings (PF ≥ 40)	129
New Drainage Facilities (blast hazard to 5-10 psi)	New Drainage Facilities (PF ≥ 40)	84
Existing Drainage Facilities (blast hazard to 5-10 psi)	Existing Drainage Facilities (PF ≥ 40)	80
NFSS Shelters, Basement, Upgraded (hazard to 5-10 psi)		76
NFSS Shelters, Basement, Vent. Added (hazard to 2 psi)		74
	NFSS Shelters, Above & Belowground, Vent. Added (PF ≥ 40)	118
NFSS Shelters, Basement (fire hazard to 2 psi)		72
	NFSS Shelters, Above & Belowground (PF ≥ 40)	114
NFSS Category 1 Basements (fire hazard to 2 psi)		
	NFSS Category 1 Space, Above & Belowground (PF 20-40)	116
NFSS Special Facilities (require individual evaluation)	NFSS Special Facilities (PF ≥ 40)	78
Expedient Buried Shelter (blast hazard to 2-50 psi)		106
	Expedient Shelter, Above & Belowground (PF ≥ 40)	130
Home Basements, Upgraded (fire hazard to 2 psi)	Home Basement, Upgraded for Blast and/or PF (PF ≥ 40)	104
Home Basements (fire hazard to 2 psi)	Home Basement (PF ≥ 10)	102
Narrow Ditches or Foxholes (fire/blast hazard to 2-10 psi)	Narrow Ditches or Foxholes (PF ≥ 10)*	94
Immersed in Appreciable Water (blast hazard to 2 psi?)	Immersed in Appreciable Water (PF ≥ 20?)*	86
	Below Grade, On or Over Water in Vertical Walls (PF ≥ 10)*	134
Immersed in Extensive Water (blast hazard to 2 psi?)	Immersed in Extensive Water and Far from Shore (PF ≥ 40?)*	88
	On or Over Extensive Water and Far from Shore (PF ≥ 40?)*	124
School Grounds	(Not Useful for Fallout-Only Regions)	90
Parks (within Built-Up Areas)	(" " " " " ")	92
Other Large Incombustible Open Areas	(" " " " " ")	

* Prompt decontamination of small areas may be required.

5. Rating Different Physical Protection

FALLOUT-ONLY REGIONS

Threat to life is fallout. Rating is primarily by protection factor, secondarily by habitability.

However, there is a quandary: How to rate "time to shelter" against "quality of protection"? To what extent should one travel farther to gain better protection? A partial answer lies in the minimum time before fallout can arrive (15 minutes) or be dangerous (30 minutes).* One can seek better shelter up to the time when fallout is first likely to become dangerous for the given locality. Beyond this minimum time there is no assured answer; it cannot be foretold whether one should risk further exposure or accept a lower protection factor. (This same quandary is accentuated in Direct-Effects Regions for the lack of a minimum time available to take shelter.)

DIRECT-EFFECTS REGIONS

Threats to life in built-up areas include at least: flash, blast, mass fire and fallout. Physical protection is rated primarily by the lowest psi peak overpressure where the protection of the occupants is significantly degraded--by whatever weapons effect--so that lethal effects may reach them or they may be left unprotected. Occupants may be incapacitated or driven out by the fire itself, by its noxious products of combustion, or by the effects of blast. Secondary rating is by protection factor, using the same minimum standards used for fallout shelters, PF ≥ 40. Tertiary rating is by habitability.

Physical protection which cannot protect its occupants from mass fire effects is estimated to fail at 2 psi. Physical protection which can protect its occupants against mass fire effects is given a failure rating $\geq$ 2 psi, depending on the blast protection it offers. (Such rating estimates appeared on the previous page.)

Physical facilities protective against all direct weapons effects are termed Universal Protection. Other facilities offer only Partial Protection; their occupants are especially vulnerable to one or more weapons effects. The potential elements of passive protection for Direct-Effects Regions listed on the previous page can be classified by protection category as follows:

PARTIAL PROTECTION		UNIVERSAL PROTECTION	
Protective Against Flash/Blast/Fallout	Protective Against Mass Fire Only	Against Flash/Blast/Mass Fire/Fallout: LOW GRADE	HIGH GRADE
Basement Shelters, Vent. Added	School Grounds	New Limited-Blast Shelters	New Blast Shelters
Basement Shelters	Parks	New Drainage Facilities	
Category 1 Basements	Other Large Incombustible Open Areas	Existing Drainage Facilities	
(Special Facilities?)		Basement Shelters, Upgraded	
Home Basements, Upgraded		(Special Facilities?)	(Special Facilities?)
Home Basements		Expedient Buried Shelter	in open areas
		Narrow Ditches or Foxholes	
		Immersed in Appreciable Water	
		Immersed in Extensive Water	

Obviously the High Grade Universal Protection should be used as much as possible since it is qualitatively better than anything else. And the Large Incombustible Open Areas should be initially avoided, since they offer the least protection. It is the first and third columns that require more extensive consideration. For protection in Direct-Effects Regions, what emphasis should be given to NFSS Identified Basements and Home Basements, and what should be done with Low Grade Universal Protection? This is a question of some importance, and the answer is diagrammed below.

FIRST WEAPONS EFFECTS	Possible Effects	(1) Fallout Only	(2) Flash/Blast/Fire/Fallout	(3) Flash/Blast/Fire
	Impact on Occupants of Shelters Vulnerable to Fire Effects	Protected from fallout by shelter; immobilized in shelter.	Protected from flash/blast by shelter; driven from shelter by postattack fire and fumes ahead of the arrival of fallout. Only recourse is (a) shelter in Universal Protection with similar blast strength.	Recourses are (a) shelter in Universal Protection with similar blast strength, or (b) escape into the interior of Large Open Areas.
	Results	NFSS Shelters (vulnerable to fire) only protect against fallout. Other weapons effects (creating fire) drive people out of these shelters and into Universal Protection or Large Open Areas.		
SECOND WEAPONS EFFECTS	Possible Effects	(1) F / (2) F/B/F/F / (3) F/B/F		
	Impact on Occupants of Shelters Vulnerable to Fire Effects	(1) Protected from fallout by shelter. (2)/(3) Protected from flash/blast. Driven outside into deadly fallout, fire and fumes.	Need not be considered since shelter is empty.	
	Possible Effects			(1) F / (2) F/B/F/F / (3) F/B/F
	Impact on Occupants of Large Open Areas			(1) Only recourse is shelter in Universal Protection. (2)/(3) All exposed to deadly flash and fallout.
	Results	NFSS Shelters (vulnerable to fire) only protect against fallout. People left previously in Large Open Areas are either lost to flash or driven to Universal Protection by fallout. After the second weapons effects, the only protection is UNIVERSAL PROTECTION.		

CONCLUSION: Shelters and shielding for Direct-Effects Regions should provide Universal Protection. Hence emphasis should be given to new blast shelters, drainage facilities, ditching of open areas, etc. (the third--and fourth!--column in the listing on the facing page). NFSS Identified Basement Shelters are not useful in this role as they stand, they must be upgraded to serve in this capacity.* Against direct effects they currently provide just one-time protection from flash and blast until their occupants are driven out by the effects of mass fire, in some cases driven out into an intolerable fallout environment.

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* Richard I. Condit, Concepts for Upgrading the Protection of Identified Fallout Shelters in Basements, Stanford Research Institute for the Office of Civil Defense, October 1965. Home basements are generally believed to be practically impossible to upgrade adequately--especially against fire and fumes--and so remain as merely favorable places for taking cover if there is insufficient time to get to adequate Universal Protection.

6. Factors Affecting the Local Approach to Passive Protection

FEDERAL AND STATE

The Federal government is the dominant authority and leader in civil defense, and very influential on local activities. Federal and State governments can affect local civil defense by:

Mandatory Requirements for Civil Defense Placed on Local Governments, Organizations and Individuals
This procedure has not been employed in this country. However, some foreign countries have made shelter mandatory.

Program Support for Civil Defense
The activity and budget for Federal civil defense operate both directly and indirectly on local efforts. Local programs can be helped with financial assistance and can be encouraged by the general activity. And in more subtle ways, the status accorded civil defense reacts through the echelons to influence the caliber and number of interested people.

Good Example with Own Civil Defense
The Federal and State governments should set a good example by positive progress with their own civil defense. This act is easier for them to do than any other, it produces valuable protection in itself, and it puts the stamp of reality on declarations of intent.

INTERNATIONAL SITUATION

Since the purpose of civil defense is to protect people from untoward consequences of international conflict, the international situation has a real affect on the local approach. However, that influence is not all direct, most of it is indirect, through the Federal government. (And of course the civil defense activities of the nation also react on the international situation, at least to a small degree.)

Coupled with the international situation and/or accelerated Federal/State civil defense programs are short term responses to increase emergency readiness. For these to be developed, there is needed a series of deadlines for planning purposes. These are shown below along with adjective descriptions for causative international situations.

	Postulated Periods for Increased Emergency-Readiness
Ruffled	1 week
Tense	2 days
Nuclear Attack Threatened	8 hours
Nuclear Attack Elsewhere	2 hours
Nuclear Attack of the U.S.	0 hours

LOCAL	CONSIDERED FURTHER ON PAGE
In the given community one must consider:	
• Threats of Enemy Attack	
• Population Distributions	66
• Mobility and Barriers to Movement	70
• Direct-Effects (Mass Fire) Constraints	
Heavier-Than-Light-Residential Areas	136
Potential Fire Storm Areas	140
Potential Regions of "No Escape"	144
• Mandatory Requirements for Civil Defense Placed by Local Authorities on Organizations and Individuals	129
• Government Facilities	125
• Related (Non-Civil Defense) Property, Programs and Plans	88

REGIONAL SURROUNDINGS

Should be examined to evaluate the likelihood of evacuation being desirable and worthwhile if time allows.

- Threats of Enemy Attack
- People Evacuating from Given Area
- (People Evacuating from Other Areas)
- (Local Inhabitants)
- Protective Facilities (and Adjuncts, Aids and Habitability Items)

  Physical Protection--Determine quality and quantity likely to be available to own evacuees (non time-dependent)

  Support Systems --Estimate capabilities at destination (and enroute)
- Readiness of Operators
- Transportation from Own Locality
- Local Ties to Destination

(Since this is not a study of complete protection planning, but only of area-wide shelter systems, no actual plan for the evacuation of San Jose will appear here. Elements related to evacuation planning are shown above for completeness, because the feasibility of evacuation influences the urgency of providing shelter locally.)

7. Planning the Physical Protection to Use for Area-Wide Shelter Systems

BASIC PLANNING PROCEDURES

Basically the planning of the physical protection to use for area-wide shelter systems consists of the following steps. Since these procedures are largely independent of whether the planning is for Direct-Effects Regions or Fallout-Only Regions, only one description is given with appropriate variations where necessary.

1. Determine the protective physical resources that exist or that could be obtained.

2. Subtract out any that should not be considered for use (e.g. too near possible targets, postattack mass fire too intense).

3. List the remaining net physical protection according to decreasing "psi" protection (settle ties with superior PF) in Direct-Effects Regions; according to decreasing protection factor (PF) in Fallout-Only Regions.

4. Establish for each physical protective facility (a) a nominal capacity based on 8-10 sq ft/person*; and where necessary (b) an emergency capacity based on a reduced space allowance, not to be less than 4-5 sq ft/person*--where there is sufficient ventilation for the regional weather (or consider as a reason for adding such ventilation).

5. Set a specific time or distance as the maximum time-to-load or distance-to-shelter for use in the given locality. For Fallout-Only Regions, in this report 30 minutes (urban) and 60 minutes (rural), will be used. For Direct-Effects Regions such a time may need to be appreciably less in some cases (in the vicinity of probable high priority targets of enemy attack, e.g. U.S. missile launch sites).

6. Determine which physical protection to use by making a Community Shelter Plan (CSP) for the effective utilization of shelter using the better protection preferentially ahead of the less protective. The nearest people are assigned first, with due regard for their mobility and any barriers to their movement. The CSP assignments are made on the basis of "a (normal) space to a (shelter) space." No account is taken of names or particular people--rather whoever is in a certain position in peacetime would go to a prescribed shelter in case of emergency. Plan for "normal" shelter occupancy @ 10 sq ft/person; and additionally, where shelter ventilation allows, plan for emergency shelter occupancy @ 5 sq ft/person. Carry both plans along until it becomes clear which is preferable. (Continued on p. 42)

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* See Federal Civil Defense Guide, Chapter 3, Part D, Appendix 1, Annex 6, especially pages 6 and 7. (Floor space less than 8 square feet per person is not generally recommended for shelter occupancy. However, in parts of the country having a temperate climate--e.g. San Jose, California--local authorities faced with inadequate shelter may consider as an emergency measure reducing the space allowance below 8 sq ft/person but never below 4-5 square feet per person.)

MAJOR TYPES OF PLANS--DIRECT-EFFECTS REGIONS

CONSIDERED FURTHER ON PAGE

BASIC PLANNING PROCEDURES (Continued from p. 40)

7. Prepare Characteristic Curves for the resulting area-wide shelter system (see next section), describing the approximate time (distance) to shelter, and protection in shelter, for that assemblage of protective elements.

8. Search for weak parts of the system and ways they can be strengthened or supplanted. Initiate program for recommended improvements.

9. Establish the possibilities for increased emergency-readiness to react to sudden needs for improved civil defense. Make suitable preparations.

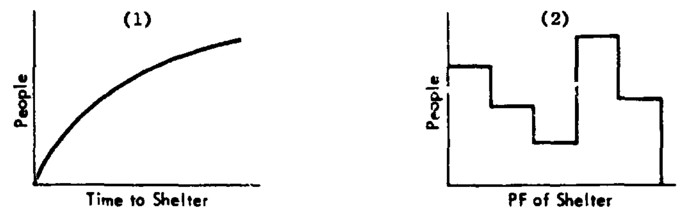
MAJOR TYPES OF PLANS--FALLOUT-ONLY REGIONS

8. Evaluating Area-Wide Shelter Systems

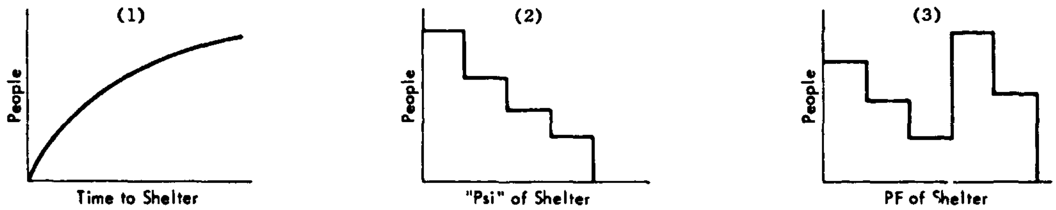
CHARACTERISTIC CURVES

Neither a community shelter plan nor an area-wide shelter system is necessarily easy to evaluate on the basis of its name, assumptions, planning procedures, or similar indefinite qualities. Rather do we need some kind of quantitative encapsulation of its essential character. This may be provided, at least in part, by a set of Characteristic Curves which shows for the system the time it takes people to be sheltered, and the protection they have when sheltered.

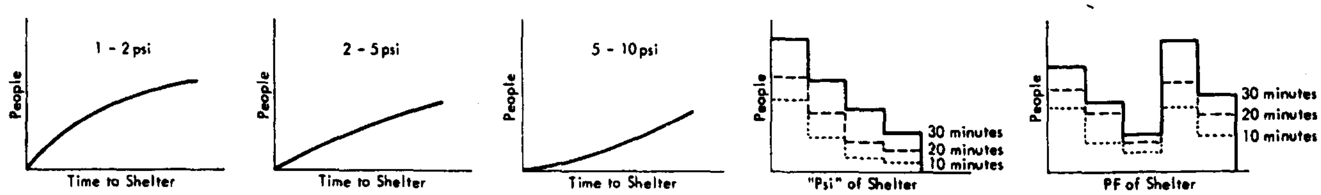
For Fallout-Only Regions, the Total Characteristic Curves plot (1) people arriving in shelter as a function of time after warning is first given, and (2) people with the different protection factors of the shelters occupied.



For Direct-Effects Regions, the Total Characteristic Curves plot (1) people versus their time to shelter, (2) people versus the "psi" protection of their shelter, and (3) people versus the protection factor of their shelter.



These Total Characteristic Curves describe at least approximately the basic operational nature of area-wide shelter systems. For more detail, one plots other curves, the Partial Characteristic Curves, showing for each protection category the time to shelter, or the protection provided as a stepwise function of time.



9. Support Systems for Area-Wide Shelter Systems

COMMUNICATIONS

Two needs exist at the local level: (1) Communications between Operators of area-wide shelter systems and to Higher Command--for which 2-way transmission is usually essential; and (2) Communications from the Operators to the Occupants of area-wide shelter systems--for which 1-way transmission is necessary and may be sufficient. Precautions for survivability in Fallout-Only Regions are limited to emergency power sources and fallout shelters from which to operate. These same precautions are also needed for Direct-Effects Regions, along with arrangements of equipment, lines and antennas which can operate in spite of mass fire and blast (at least to the limit of the best shelters).

For Shelter Operators, it is assumed that short wave radio facilities will normally serve, supplemented where possible by telephone. These may include the existing State and local government nets for police, fire, public works and administration. And augmentation may be possible with selected amateur radio operators as presently planned under the RACES program. Increased emergency-readiness might be obtained by adding other non-governmental short wave capabilities: taxicabs, tow trucks and contractors. In Direct-Effects Regions, antennas should be well removed from combustible materials and specially braced against blast. Duplicate antennas for quick erection may need to be stored.

For Shelter Occupants, it is essential that broadcast radio (AM) be used. This can be supplemented by other radio or telephone links, but broadcast radio cannot be omitted (because some people may not make it to the shelters provided with special communications, and their only source of information will be broadcast radio). Portable receivers should be emphasized. In Direct-Effects Regions antennas may need to be strengthened, or erectable, or specially resistant.

Possible System Components:

<table>
<tr><th>TRANSMITTERS</th><th>RECEIVERS</th></tr>
<tr><td>Master Long Wave Radio Stations</td><td>Special Master Radio Receivers</td></tr>
<tr><td>Selected Standard Broadcast Radio Stations (EBS)</td><td>AM Receivers: Home, Car, Portable</td></tr>
<tr><td colspan="2">Special Shelter Short Wave Radio Sets</td></tr>
<tr><td colspan="2">Normal Government Short Wave Radio Sets</td></tr>
<tr><td colspan="2">Other Commercial Short Wave Radio Sets</td></tr>
<tr><td colspan="2">RACES Amateur Radio Sets</td></tr>
<tr><td colspan="2">Supplemental Military Radio Sets</td></tr>
<tr><td>Telephone Circuits, Information Services, "Fan Out" Calling</td><td>Normal Telephone Terminals, and in Shelters</td></tr>
<tr><td>Sound Power Augmentations: Bullhorns (pedestrian, motorized, airborne), Sirens/Horns/Bells, Public Address Systems</td><td>Ears</td></tr>
<tr><td>Runners Bearing Messages</td><td>Eyes and Ears</td></tr>
</table>

WARNING

Alerting/warning the general public from tactical information or weapons effects uses high-power outdoor sirens. Confirmation and further instructions (and strategic warning) come over standard AM broadcast radio.

Interrelations with Communications, Readiness and CD Organization. Warning is intimately related to Communications, Readiness and CD Organization. All forms of communications mentioned on the facing page should be exploited for Warning. The Readiness of the general public (as Occupants) affects both the area coverage and the message content of Warning. The more unprepared the people, the more explicit and detailed must the warning messages be. People prepared and ready can be sent to shelter promptly with minimum communication. Passive protection will improve as CD Organization and Readiness provide on-the-spot leaders to prepare people and lead them to shelter when necessary.

Special Requirements of Direct-Effects Regions. Warning for Direct-Effects Regions is more difficult than for Fallout-Only Regions. There is severe fire and damaging blast to degrade the physical equipment and lines involved (unless they are protected therefrom). In addition there are greater needs for warning. More than one attack or weapons effect may be experienced. To protect against later attacks, a postattack capability for warning is needed to get people back into shelter. Two kinds of warning are pertinent: warning to take shelter (to gain protection from exterior hazards), and warning to evacuate the shelter or building (to avoid involvement in interior hazards). The latter would normally be more localized than the former. Different signals may be necessary, and procedures to follow when both are sounded need to be evolved. Thus in Direct-Effects Regions one needs a warning system which works both before and after attack, and in spite of possible physical destruction; and which can send people in or out of shelter as circumstances require.

Possible Sources of Warning:

OFFICIAL

Government National Warning System
- Strategic
- Tactical
- Weapons Effects--Direct-Effects Regions
  - Affected by Explosion
  - Disturbed by Explosion
- --Fallout-Only Regions
  - Communication from Direct-Effects Region
  - Detection of Rising Gamma-Ray Background

Telephone Co. "Bell and Light" Installations
- Tactical Only

UNOFFICIAL

Pronouncements of Non-Officials
- Strategic Only

Do-It-Yourself
- Strategic
- Weapons Effects--Direct-Effects Regions
  - Affected by Explosion
  - Disturbed by Explosion
- --Fallout-Only Regions
  - Communic. from D-E Region
  - Detection of Gamma Rays

9. Support Systems for Area-Wide Shelter Systems (Continued)

RADEF

A continuing capability to assess the radiological situation (and to convey it to shelterees) is essential to any area-wide system of shelters. The Radiological Defense system which performs this function must necessarily depend heavily on the allied services of Communications, Warning and Emergency Direction and Control.

In general, RADEF for an area-wide shelter system should be built up of the following capabilities to assess the outside gamma-radiation field:

Area To Be Evaluated	RADEF Instrument Location	Communications Needed for RADEF--EOC to Shelter	Communications Needed for RADEF--Monitor Station to EOC
Shelter Sites	Each Shelter	No	No
EOC Site	EOC	Yes	No
Total Area	Monitor Stations spotted throughout the area	Yes	Yes

In practice, some Monitor Stations may be Public Shelters. This is the current SOP in San Jose where the Monitors are largely personnel of the Fire Department who go to predesignated public shelters in an emergency. Any communications involved must be prepared to survive and function as required by their location in Fallout-Only or Direct-Effects Regions.

Possible Contributors to RADEF System

Measurements Out of Area
Area-Monitoring Measurements
Measurements at Other Shelters

Communicated to EOC

Measurements at EOC

EOC Interprets and Communicates to Shelters

Increased Emergency-Readiness

Refresher training and testing of monitors and their instruments.

Where capabilities are yet deficient, augment with new monitors/instruments.

Where sufficient local monitors cannot be produced (or have not been produced), request (or send in) trained military units (uncommitted Reserve or National Guard) to provide supplemental monitors/instruments/communic.

Add a recording, automatically alarming instrument for gamma-ray measurement to the EOC.

EMERGENCY DIRECTION AND CONTROL

The outstanding source of pertinent information for Occupants or would-be Occupants of area-wide shelter systems is the local headquarters for emergency guidance, nominally located in a protected facility: the Emergency Operating Center (EOC). The proper functioning of the EOC is dependent on the Communications, Warning and RADEF systems.

Regular Community Procedures

The essence of Emergency Direction and Control is (1) suitable people, duly authorized, and adequately prepared; (2) housed in an EOC configured for the jobs to be done in an emergency, with protective features appropriate to their Fallout-Only or Direct-Effects Region, and located sufficiently near their normal working/living places to facilitate their rapid assembly whenever necessary.

The EOC is normally located in a protective facility specially constructed for that purpose, or in the nearest suitable space in ordinary buildings identified by the NFSS. While this latter may suffice for Fallout-Only Regions, if it is in a built-up area it will have to be upgraded considerably (especially to protect against mass fire and its effects) if it is to serve a Direct-Effects Region.

Expedient Community Procedures

Communities which have not previously developed their own Emergency Direction and Control may find this a desirable goal, if and when they feel it necessary to increase their emergency readiness. This can be attempted as a bootstrap operation to generate quickly a suitable staff and protective facility, or perhaps teams of Reserve Military or National Guard previously prepared for this role could be requested or could be sent in (although such plans would have to be worked out very carefully since such sources presently have a priority military mission). Presumably the latter would usually serve as trained staff for local civilian authorities.

In Direct-Effects Regions having no prepared EOC for their Emergency Direction and Control, or where the EOC has been rendered unusable by weapons effects, some kind of expedient headquarters should be set up. This eventuality suggests that vital EOC equipment be available in portable kit form, including battery-powered communications for contacting outlying monitors and the local EBS radio broadcasting stations. The personnel involved should be prepared to transfer or establish their operations in any protected space on short notice, be it public shelter, large storm drain, boat, or what have you.

Private Associations and Do-It-Yourself

There are some actions for passive protection which a few individuals and/or organizations anxious for civil defense can usefully pursue in a community otherwise disinterested in civil defense. While such actions are advantageous and much better than doing nothing, they have definite limitations, and are generally inferior to what a community can do if it is interested and active.

10. Readiness for Area-Wide Shelter Systems

TRAINING FOR READINESS

While certain physical arrangements of various inanimate materials are necessary ingredients of area-wide shelter systems, people are also indispensable to the same--both the people who are to operate, and the people who are to occupy area-wide shelter systems. The state of preparedness of these essential Operators and Occupants is the concern of Readiness.

In general, Readiness for civil defense functions is perforce the consequence of training--or lack of training--for this is not the sort of thing that can be learned by actual experience. (When the chance for experience, i.e. nuclear attack, comes it is too late to learn! we must already know what to do!) Requirements for Readiness apply to thousands of Operators and millions of Occupants; there necessarily results a training problem of monstrous proportions.

It seems that the need for popular training for Readiness in civil defense is large compared to the training capabilities of civil defense agencies, but small compared to the training capabilities of the normal educational system. One can but conclude that the training of people for civil defense could be effectively worked into their normal training. Civil defense could be taught at home, at school, at work, at play, in the military services, etc., like any other subject that is an essential part of living. The primary role of Civil Defense agencies is thus seen as working for adequate civil defense training in normal training programs, rather than trying to provide such training themselves.

The local needs are enormous. The Mayor needs training in civil defense, the local Head of Civil Defense even needs such training, the City Engineer needs training, so do the Chief of Police and the Fire Chief--along with all the men in their Departments. Those responsible for safety, communications, vital records, city planning, fire ordinances, parks, schools and school grounds, reservoirs, storm drainage, electrical, gas and telephone service, all need training. Members of the medical profession need training. Heads of industry, churches, business, fraternal and service organizations need training in civil defense. Heads of families, adults generally and countless children need instruction and guidance.

THE SPECIAL ROLE OF NEIGHBORHOOD FIRE STATIONS

Unfulfilled needs for responsible safety personnel seem greatest in the widespread areas of American communities composed largely of single family residences. The most appropriate existing public service agency for this role is believed to be the neighborhood fire station. The concept, then, is to have every neighborhood fire station become a center within the community for the development of civil defense (as well as other safety measures for which the fire services have traditionally been responsible).

This would necessitate (1) an enlargement in the scope of Fire Department responsibility, (2) commensurate increases in budget and personnel to fulfill this increased responsibility, (3) a thorough training of all Fire Department personnel in ways of advancing civil defense in their precinct, (4) a large addition of Auxiliary Fire Department personnel trained in civil defense to be better able to work with the public personally, and (5) the installation of certain protective facilities at each fire station, to serve as prototypes for the community. More on this latter point on page 112

THE NEED FOR EMERGENCY TRAFFIC CONTROL

Insofar as moving vehicles within the community may constitute a serious barrier to pedestrians attempting to go to shelter, there should be developed as part of Readiness a capability for emergency traffic control. Well conceived plans for Movement to Shelter can reduce the likelihood of interference between moving vehicles and shelter-bound pedestrians. Police and their auxilliary forces can make a valuable contribution here as well. But preconceived plans may not always suffice, and policemen cannot be everywhere (nor can they neglect getting into shelter themselves), so some instruction in expedient means for stopping interferring traffic may well be appropriate for shelter Operators and Occupants.

11. Attitude and Support for Civil Defense

THE CONCERN FOR SUPPORT

It is relatively easy to write the technical specifications for an area-wide shelter system appropriate to a given community. But to make any such system become an actual fact--built, operating, protective, and paid for--seems to be relatively difficult. As long as this is the case, an important part of any program for civil defense should be directed at the attitude and support for civil defense of the people concerned, be they (1) key individuals, (2) influential organizations, or (3) the general public.

The process of improving civil defense thus presently requires not only the provision of the improvements themselves but the creation of the desire to provide, or willingness to accept, those improvements. It is this creation of desire or willingness to accept with which we are concerned under Attitude and Support for civil defense. Civil defense is not "IN." If it is to become a part of our lives in time to be of value it must be sold in advance of the moment of need. That sale is more likely if there is support for the valid civil defense that exists, and demand for more and better civil defense. To realize area-wide shelter systems it seems necessary to promote not only the essential Facilities and Readiness for civil defense, but the very idea of civil defense itself (and the notion of actually doing something about it).

SNOWBALLING SUPPORT FOR AREA-WIDE SHELTER SYSTEMS

Anyone who wants civil defense for himself should want civil defense for others--for both altruistic and selfish reasons. The first step is the realization of the high value of civil defense in case of attack (Chapter II), and the small cost of civil defense in case there is no attack. The cost is so small relative to the value if needed, that Americans can readily afford to buy the system just in case. As expressed previously:

> "The nuclear protection of an urban population is a considerable problem. It has yet to be seriously attempted in this country (although Sweden is well along and other foreign countries are under way). If implemented it will necessarily involve large investments of resources--perhaps even comparable in scale to the amount presently spent on lipstick or on Coca-Cola (but not so much as on lipstick and Coca-Cola). It is a job that can be done technically and economically...."*

Thus many of us could provide our own protection on our own land where we have our homes. And for those who never leave home that protection could provide much of the total protection needed.

---

* Richard I. Condit, Civil Defense Aspects of Urban Renewal Plans for Norfolk, Virginia, Stanford Research Institute, November 1962.

For those of greater mobility, the second step is the realization that they are not at home (with their own postulated protection) 24 hours a day, 365 days a year, and whenever they leave home they are unprotected. Since protection from nuclear attack seemed like a good thing at home, one would like to have it as well away from home, for his kids at school, and for his wife while shopping or visiting friends. Because of our normal mobility, no individual or family can provide itself complete protection with just its own resources. And no organization of individuals can do it either, except the combined citizenry that is the United States. So if I know enough to appreciate having my own protection (at my own home, say), I should work to have others feel the same. For I won't always be at home, and when I'm away I would like to use their protection. (And when they visit me I would like them to use my protection.)

Thus every person who sees the value of passive protection should be interested in having it become widespread and public. Each person interested sees the benefit of having others interested. This is the essential requirement for the snowballing of interest in community protection, in area-wide shelter systems.

Lastly, for technical and economic reasons, people interested in civil defense should logically want more people to be so inclined. Economically, it is cheaper to build and operate several large shelters than myriad small ones, so this favors the provision of community protection rather than the individual approach. And technically, the best sites for such large public shelters in Direct-Effects Regions are generally the large incombustible open areas within the community: school grounds and parks. These sites are already publicly owned and so favor public development into nuclear protection.

EVALUATING ATTITUDE AND SUPPORT

The ability to measure the Attitude and Support for civil defense of a given community should be valuable, for then quantitative evaluations and comparisons become possible. These may reveal when and where a given program for passive protection is succeeding or is in trouble, and suggest which previous action was effective or why remedial measures are needed.

Community Attitude can be and commonly is measured by conducting opinion polls, or evaluating the civil defense content of printed material published in the locality of concern.

It is tentatively suggested that Support be measured by funds applied to civil defense, be they for individuals, organizations, local government, or the community as a whole.

12. How Organizations and Families Can Improve Their Protection

In principle, communities can always provide a better overall system of protection than can lesser organizations or lone families. On the other hand, any given organization or particular family with enough resources can make its own physical protection (for people on its property at the time of attack) better than that of the community--at least for Fallout-Only Regions.

In practice, one must examine his actual state of affairs: What is the community doing for passive protection? Could the community be induced to do more? What resources could be committed to civil defense by one's organization or by one's family? How would any personal contribution to own civil defense compare relative to one's share of the community effort?

In principle, the community approach to civil defense is intrinsically cheaper than similar protection provided by the organizations and families of the community acting independently.

In practice, if the community does not provide a satisfactory system for passive protection, individual organizations and families can improve their own protection enormously by their own efforts and resources--albeit at a somewhat higher cost than if the community had done it.

CONCLUDE

If the community has not done much for civil defense, interested organizations and families/individuals will generally find it worthwhile to:

1. Provide their own protection on their own property now.

2. Work to get the community to eventually provide an area-wide shelter system for everybody (including themselves when away from their own property).

The essence of operational civil defense is physical protection, pertinent information, and a readiness to use properly both the protection and the information.

It is relatively easy for the community (i.e. local government) to arrange to provide the pertinent information needed to support area-wide shelter systems. This is relatively difficult for private organizations or individuals to do.

It is relatively difficult for local government to build physical protection with its own resources (just the problem of financing an area-wide shelter system is almost insoluble for most local governments*). For organizations and families with adequate resources it is relatively easy in principle to build their own physical protection; admittedly such action is not easy in actual practice at this time. Such individual action could be facilitated by the adoption of national shelter standards for economically-priced family shelters, suitable for mass production and installation, with production and distribution subsidized by the Federal government if necessary.

As previously mentioned, means adequate to the needs for preparing people to operate and occupy shelters--as required for readiness--have not yet been utilized. in most communities. Still much of this could be done individually by interested organizations and families using only their own efforts. One way to further such readiness would be to include suitable instructions with any private shelter installation, along with fact sheets about any community system for providing emergency information.

CONCLUDE

In our present stage of developing civil defense, possible public/private combinations of capabilities should not be neglected. Thus local government may well focus some of its early efforts on an area-wide system for providing essential information in case of emergency--including nuclear attack. Such information is necessary anyway for public shelters, and until those shelters are provided in adequate quantity would allow private organizations and families to operate their own shelters effectively. Even with sufficient public shelters, some organizations and individuals may want to invest in their own special physical protection for which essential information is necessary for satisfactory operation and is most readily provided by total community resources.

* Ernest C. Harvey, Financing a Nation-Wide Shelter Program, Stanford Research Institute for the Office of Civil Defense, January 1965.

13. Composite Systems of Protection

One next takes the features and components of passive protection (previously outlined in this chapter) and tries to put them together in the best way possible for the civil defense of the community involved. This will rarely be a straightforward act. Perhaps the simplest situation would be a community with little or no civil defense. There the aim should be to get the people to (1) realize the potential protection intrinsic to the existing physical facilities, and (2) develop a desire for more and better civil defense. Neither of these aims is necessarily easy to accomplish, and the procedures required may be far from trivial. At the other end of the spectrum of possibilities might be the community which actually decides to build an area-wide system of proper new shelters for everyone. Such a commendable goal will take some considerable doing to reach, but, in addition, because the construction of such a system takes appreciable time, other existing protection should be considered for use in the interim. While building adequate shelters we may yet have to seek protection in buried culverts, or water-filled ditches. For we must use to the limit whatever protection we have at all times--including the times when new shelter is abuilding. So in this case one may end up having to develop 2 civil defense systems, one for interim use and one for eventual use.

The actual situation in real communities tends to be more complex than either of these simplified examples. Determinations must be made of the available protection--and this will generally vary from PF Category 1 to PF Category 8, a range of about 3 orders of magnitude. Arrangements must be made and procedures must be evolved for the proper use of that protection. Thousands of people must be informed of their intended shelter or shielding, convinced of the value of protection themselves, and instructed in the proper preparations and emergency procedures. Sheer numbers will confound the difficulties. And a variety of facilities, approaches and practices may have to be included. Decisions will have to be made between better protection farther away, and lesser protection that is closer. And a price will have to be put on habitability. What is it worth to a given community to have better living conditions in a facility to be occupied only in case of nuclear attack? How do the local people evaluate better protection versus better living conditions, where both cannot be had simultaneously (at least not until new shelters are built)? Initial efforts may well be directed at providing some kind of shelter or shielding for everyone. But no sooner is this done than consideration must be given to possible ways of improving that heterogeneous protection, especially where the ratio, $\frac{\text{protection}}{\text{threat}}$, is low. Characteristically, the situation is ever-changing.

As a consequence civil defense programs are rarely pure and unidirectional. Rather do they tend to consist of different activities aimed at a variety of goals often involving a large spread in quality, capabilities and understanding; they may well be a hodgepodge, resulting from efforts to progress wherever progress is possible.

For San Jose, it is certainly not our role to attempt to record what the civil defense policy of the City has been in the past, nor to suggest what that policy should be in the future. But in order to carry out this outline of protection planning, some kind of guideline policy is needed to facilitate the selection of the approaches to feature. So for illustrative purposes only, and to allow us to proceed, the following will be used:

ASSUMED GUIDING POLICY:	Increase and improve protection on a modest but worthwhile scale while gaining experience about best ways to increase and improve protection on a large (community-wide) scale, while preparing for increased emergency-readiness, while preparing better means to provide mass readiness, while studying how to build demands for more and better civil defense.

The systems of protection which evolve in actual communities tend to be <u>composite</u>--tend to be a mishmash of the old and the new, the appropriate with the inappropriate, the highly protective with the barely protective. In any case the attempt should be made to provide in such systems of protection adequate coverage of each of the three basic Program Objectives for Civil Defense--as previously displayed on page 34 of this chapter--and repeated below:

1. FACILITIES
   - Physical Protection
     - Shelters
     - Shielding
     - Large Open Incombustible Areas
   - Support Systems
     - Communications
     - Warning
     - Radiological Defense (RADEF)
     - Emergency Direction and Control
2. READINESS
   - Operators
   - Occupants
3. ATTITUDE AND SUPPORT

Given a suitable guiding policy and an outline of the proper features to include, we can proceed to define specific objectives for a particular composite system of protection. This has been done in summary form on the following pages. While that summary has been made as general as possible, it was done with San Jose in mind, and where specific conditions are implied or particular circumstances are referenced, they are those of the City of San Jose.

14. Specific Objectives for Composite Systems of Protection

In the following abstract we attempt to suggest specific objectives for a composite system for a Direct-Effects Region (San Jose). While this cursory example is neither definitive nor comprehensive, we hope it will be illustrative. On the left is the "regular" program. On the right is the accompanying program for "increased emergency-readiness," according to the amount of time presumably remaining before nuclear attack might occur (see page 38).

REGULAR PROGRAM

FACILITIES

Physical Protection

Shelters--30 psi	Build some new community blast shelters in open areas to get representative experience; supplement where appropriate with prototype family shelters at Fire Stations--inform public of their options for protection.
Shelters--10 psi	Build some new limited-blast shelters in open areas to get representative experience; supplement where appropriate with prototype family shelters at Fire Stations--inform public of their options for protection.
Shelters--5 psi	Determine blast resistance of NFSS basement shelters suitable for upgrading against fire. Plan their development. Raise blast resistance to 5 psi for valid/representative experience.
Shelters--2 psi	Upgrade as many basement shelters against mass fire and fumes as the budget will allow.
Shelters--1 psi	Continue Survey, Licensing, Marking and Stocking of large reinforced-concrete basements. Add ventilation to some for experience. Organize to employ (and upgrade) home basements.
Shielding--5 psi	Design and lay out protective dry trenches (covered) for large open areas. Plan their construction, execute contingency contracts for "crash" construction. Prepare sample trenches, shored and covered, for experience--determine useful life. Prepare sample buried culverts as permanent "trench shielding"--make some new, and some of old trenches. Modify existing covered drainage facilities for use as shelter; build new drains as shelter.
Shielding--1 psi	Explore possibilities of raising water level in creeks and rivers, perhaps in connection with plans for their development for parks and recreation, and water conservation. Raise water level where useful and feasible. Explore utility of swimming pools for shielding.
Large Open Areas (Schools and Parks)	Identify and mark those useful for passive protection. Place signs in all shelters showing nearest useful open areas and best routes there. Work out long range plan for their development for civil defense (including trench and buried shelter construction).
Special Facilities	Explore with owners of New Almaden Mines the feasibility of a joint development of the mine tunnels as they are reopened, to make them suitable for permanent shelter.

INCREASED EMERGENCY-READINESS PROGRAM

2 Hours	8 Hours	2 Days	1 Week
Until this kind of protection is available for everyone, occupy to maximum extent possible=2 x nominal capacity.			
Until this (or better) protection is available for everyone, occupy to maximum extent possible=2 x nominal capacity.			
....	....	....	....
....	....	....	....
Take available supplies into any home basements to be used for shelter--keep portable.		Get adequate supplies into any home basements to be used for shelter--keep portable.	
People planning to use unprepared drainage facilities for shelter should prepare food & water, pocket radio, emergency lighting and first aid in portable kit.		For existing drainage facilities to be used as shelter: prepare access, erect signs, close ends and inlets with sandbags (or equivalent), add ventilation, lighting, and survival stocks.	
Assemble emergency supplies to accompany water shielding.		Raise water level in creeks and rivers. Prepare swimming pools to be used for emergency shielding. Assemble emergency supplies to accompany.	
....	Have people remaining and unsheltered dig own foxholes or trenches according to planned layout. Cover as feasible.	Machine dig protective trenches, shore and cover, as required.	Machine dig protective trenches, shore and cover, as required. Add stocks.
Send unsheltered people to New Almaden Mines to extent of capacity as shelter.	Estimate current capacity as shelter. Erect directional signs for rapid loading.	Stock and ventilate tunnels suitable for shelter. Make loading plan.	Prepare suitable tunnels for shelter, stock and ventilate. Make loading plan.

14. Specific Objectives for Composite Systems of Protection (Continued)

REGULAR PROGRAM

Physical Protection (Continued)	
Gamma-Ray Shielding	Construct new drainage facilities as blast-resistant fallout shelter.
Mass Fire Reduction	Restrict acceptable construction to fire resistive materials and procedures; limit extent of allowable combustible contents. Study other possibilities for nuclear fire prevention.
Support Systems	
Communications	Evaluate the "psi hardness" (mass fire and blast resistance) of the present systems of communications including broadcast radio. Plan their progressive hardening to 50 psi. Implement as feasible. Rehearse the communications procedures periodically.
Warning	With adequate outdoor sirens, well maintained, establish integrated backup capabilities to make siren operation believable as a notice of nuclear attack. This requires (1) preattack, suitable confirming information and instructions via all forms of communication, including broadcast radio, telephone "Information," cruising cars with loudspeakers, etc.; and (2) postattack, the same via broadcast radio and any special shelter communications.
Radiological Defense	Make radiological monitoring a normal skill of city police, fire and public works personnel. Conduct refresher training and testing periodically. Develop a corps of capable monitors so that every public shelter can be so supplied. Install a recording automatically-alarming gamma-ray detector in the EOC.
Emergency Direction and Control	Evaluate the "psi hardness" of the existing EOC. Plan for its progressive hardening to 50 psi. Examine the possibilities for emergency direction and control from other protected sites, in case the existing EOC is rendered unusable. Provide the necessary adjuncts for such operations in portable form.
READINESS	
Operators	(See above under Support Systems.)
Occupants	Include civil defense in the normal training of city employees. Work to get civil defense integrated into the regular instruction at public schools. Prepare to provide special instruction for the general public as required for increased emergency-readiness. Develop the neighborhood Fire Station and its personnel as a local center for civil defense.
ATTITUDE AND SUPPORT FOR CIVIL DEFENSE	Determine the attitude and support for civil defense which is held in the community by key individuals, influential organizations and the general public. Design a program to improve the attitude and increase the support, if necessary.

INCREASED EMERGENCY-READINESS PROGRAM

2 Hours	8 Hours	2 Days	1 Week

Add massive materials as required to raise the Protection Factor of spaces to be occupied as shelter.

Shut off hazardous utilities and processes

Eliminate exposed combustible kindling indoors and out; eliminate, cover, or reinforce glass windows where feasible.

Test broadcast radio reception in shelter and add antenna wires as necessary to make reception adequate.

Relocate communications gear as necessary to serve shelters to be used against direct effects. Strengthen antenna installations (e.g. with additional guy wires). Store spare antennas in shelters to replace those lost.

Remind the public of the nature of warning signals and the appropriate actions to take for protection.

Check that all equipment for warning is in good working order.

Preposition monitors near shelters they are to occupy.

Conduct accelerated RADEF training as required or requested. Distribute any excess instruments.

Preposition operating personnel near EOC (and near alternate emergency site).

Give refresher training for operating personnel.

Test readiness of personnel and equipment.

Prepare alternate site for emergency EOC operations, in case existing EOC is lost.

Prepare existing EOC to withstand direct effects: mound dirt against walls, add internal supports for ceiling and walls.

.... (See above under Support Systems.) ....

State the action to be taken in clear, simple terms.

Issue instructional material to increase the emergency readiness of the general public. Firemen increase their attention to the readiness for civil defense of the people in their precincts.

....

15. Plans for Execution of Selected Programs for Protection

The proper expansion and completion of the foregoing should produce a definite program for an area-wide shelter system (including its essential supporting elements). Each entry should be sufficient to tell the next person involved what to do in general terms. (That person, presumed to be responsible and adequately prepared, in turn would generally work out his own approach and the specific details involved.) So the program is defined--and it is hoped, well defined. Now we would consider briefly the execution of that planned program.

Even a perfect plan may not produce a perfect product. For there can be "many a slip 'twixt the cup and the lip." Therefore it is advisable to also prepare an organized procedure for making the program become reality. In short, a plan of execution is needed.

Since this particular research is an investigation of area-wide shelter systems, not their actual production, we have not generated any plan of execution. We put this entry here in the outline for completeness. Whoever does build an area-wide shelter system will want a plan of execution to guide his effort to obtain what is wanted.

The keys to insuring proper execution are to choose competent and reliable action agents or contractors, enlightened supervision, careful scheduling and feedback from the one to the other. The supervisor/inspector must know both general intent and specific details, must be willing to change the latter to obtain the former, must be able to explain any features of the plan which are not understood, and must be able to sense when a misunderstanding is arising. Mistakes should be caught as soon as possible and corrected as smoothly as can be. Some kind of monitoring of program progress will be necessary to know what is happening (or not happening), and sometimes surveillance may have to be practically continuous. Program elements may have to be checked and double checked to be sure they are right and on schedule. Schedule delinquencies should be recognized as they happen and corrective action taken where feasible.

Proper program planning will produce better area-wide shelter systems; such planning is necessary but not sufficient. That program must still be properly executed to produce the intended protection. Proper execution is more likely when it is planned and suitably controlled.

16. Review and Updating of Protection Planning

Finally, it is noted that the planning of protection for any real community should be continuous. We plan today on the basis of what we know and have and think we should use in this way today. Tomorrow we may know more or our resources may be different or the urgency may have changed, and perhaps corresponding alterations in plan should follow. If not tomorrow then next week or next month or next year. While a given plan for protection must have appreciable longevity and considerable continuity with the next plan to follow (if much of anything substantial is to come of it), it is the rare plan that is so well prepared that it need not be altered or improved with the passage of time or the changing of circumstances.

A review and updating of the program for protection should be carried out regularly and whenever conditions warrant. (Since we are concerned in this research chiefly with the formulation of the first preliminary plans for protection, no actual review or updating of community plans has been attempted here.)

IV PROTECTION PLANNING ELEMENTS FOR SAN JOSE GENERALLY

From the broad outline of protection planning in the previous chapter we now proceed to examine in some detail certain vital elements of protection for San Jose, California. This chapter will treat such elements for San Jose generally; the next chapter will be reserved for any particular considerations required of the downtown (central business district) part of San Jose--especially pertinent for planning protection from direct effects.

Figure 12

AERIAL VIEW OF SAN JOSE, CALIFORNIA

FEATURES OF SAN JOSE

City Boundary

Our standard base map of San Jose, California, is reproduced on the facing page. Other communities are also on that map including Campbell, Los Gatos, Saratoga, Cupertino, and Santa Clara, which abut or intertwine with the city limits of San Jose. The City of San Jose has been incorporating outlying areas as feasible, and as a consequence its current boundary (not readily discernible on the facing map) is very irregular. While the bulk of the City lies on the map shown, a few appendages extend somewhat beyond. These have been ignored in the following study. (Our results would not be significantly different if they had been included.) Because of the highly irregular City limits it seemed impractical to restrict this study just to the corporate boundaries of San Jose. Instead we have taken as our region of interest the general area of San Jose that appears on this map (irrespective of whether some of the specific areas involved were actually in Campbell or Santa Clara County or whatnot). However wherever it was necessary to get information from local government we only went to the City of San Jose (and its several school districts)--since this was the only community officially involved in and cooperating with the Five-City Study.

Area

Estimated as 110 square miles (1964).

Topography

Generally flat and free of major features or irregularities. Average elevation about 80 feet above sea level in the central region. City traversed by three natural drainage gullys of appreciable size (taking runoff water north to the San Francisco Bay). Two of these converge near and pass through the central business district.

Climate

Mild. Low winter temperature 38 degrees; average high, 81 degrees; average rainfall, 14.87 inches, largely between November and April; low humidity and cool nights.

Location

On south San Francisco Bay, 50 miles from San Francisco, 42 miles from Oakland, 390 miles north of Los Angeles.

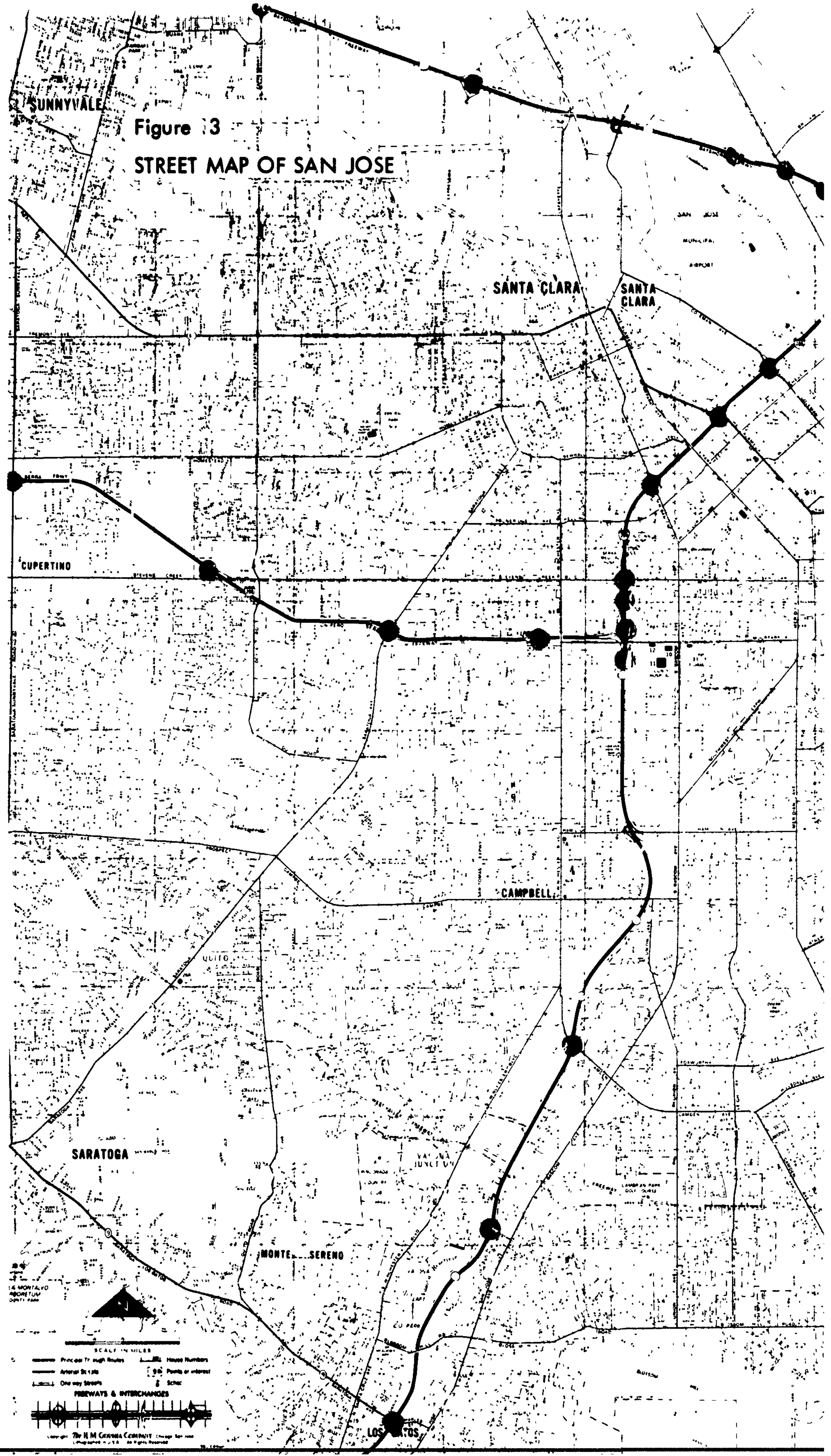
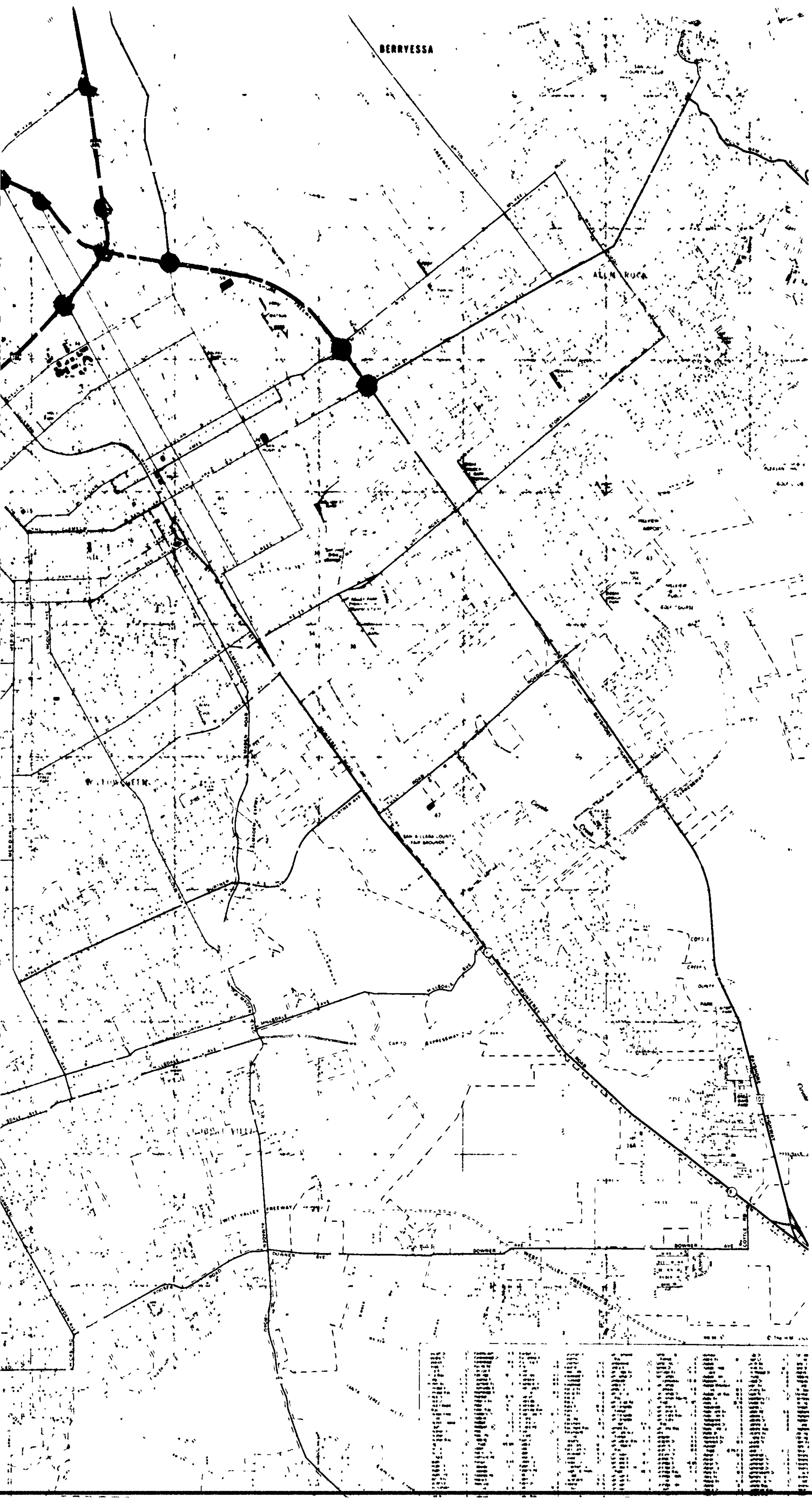


Figure 13
STREET MAP OF SAN JOSE
SUNNYVALE
SANTA CLARA
SANTA CLARA
SAN JOSE MUNICIPAL AIRPORT
CUPERTINO
CAMPBELL
QUITO
SARATOGA
MONTE SERENO
LOS GATOS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POPULATION OF SAN JOSE

Population

Estimated as 204,200 in 1960; increasing to 317,000 in 1965--according to the San Jose Chamber of Commerce. This large growth resulted from two causes: (1) more people residing in the Santa Clara Valley, and (2) more area of that valley annexed to the City.

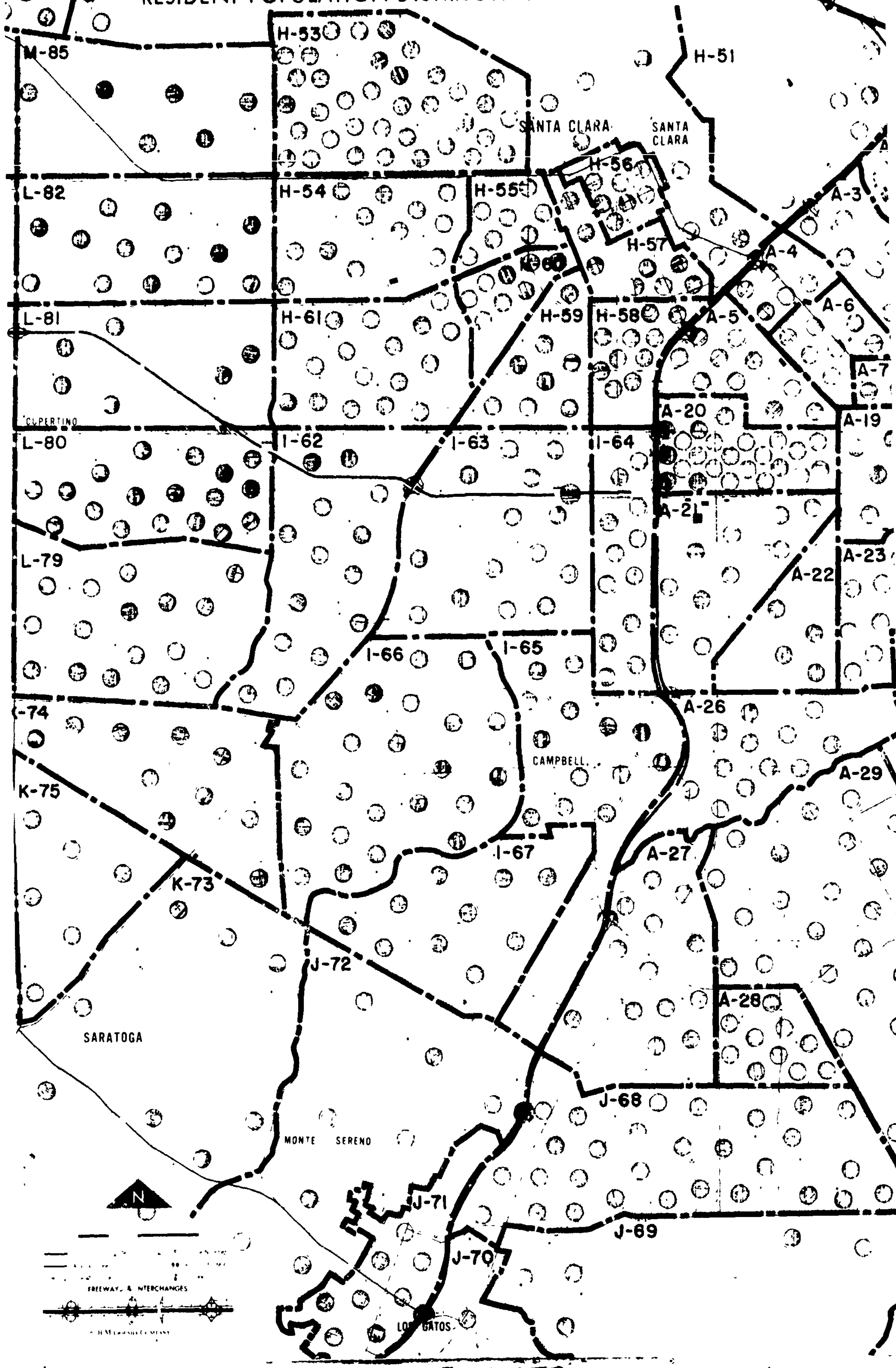
Population Distribution

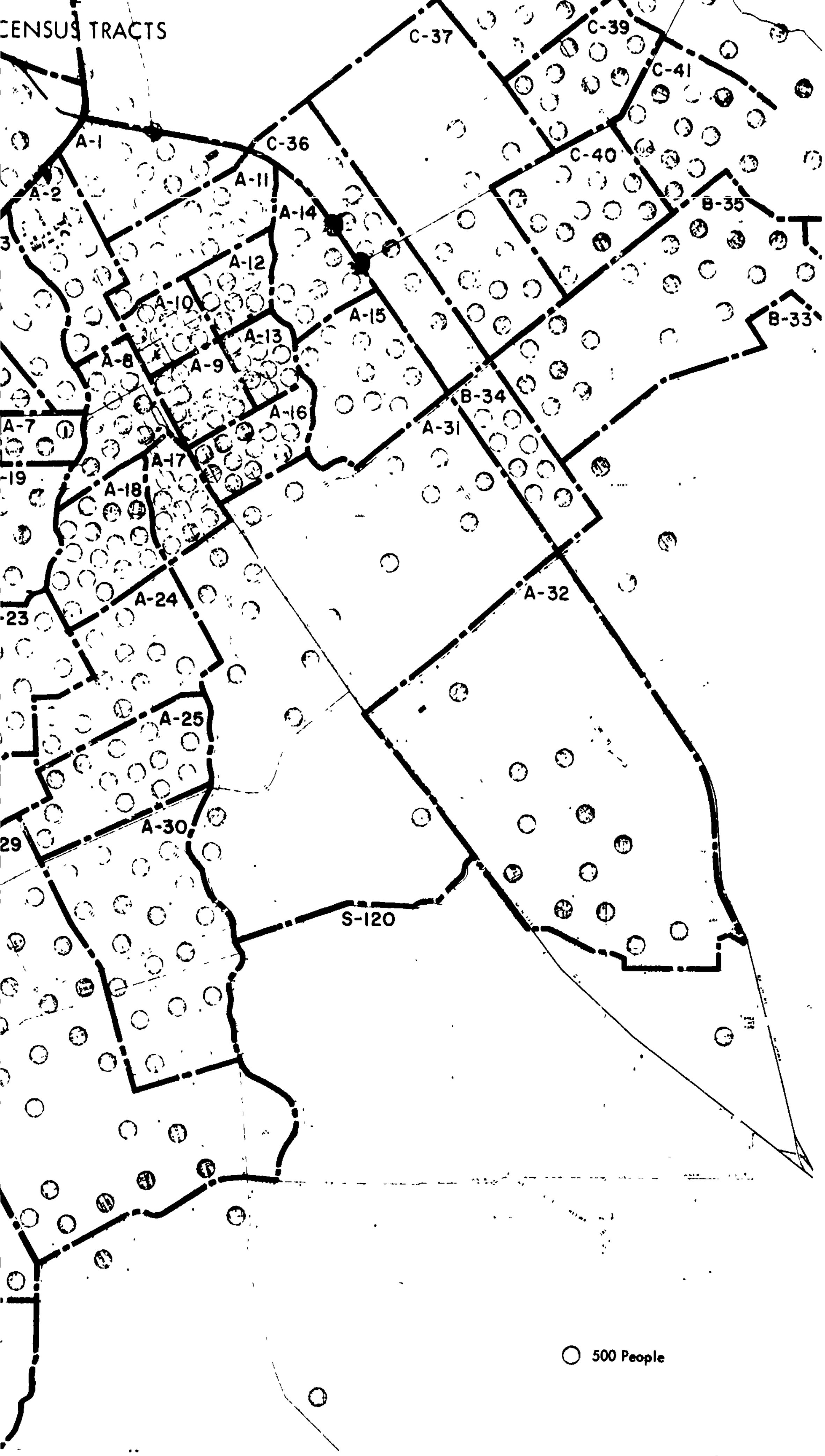
Figure 14 (facing) shows the approximate distribution of people by residence, according to the 1960 Census, as reported in the National Location Code, OCD-OEP, Region 7 (dated 1962). The data used gave resident population by Census Tracts. Census Tract boundaries are also shown on Figure 14. Letting each dot represent 500 people, the number of dots to allot to each Census Tract was determined. The dots for a given Census Tract were then distributed within that Census Tract by eye, concentrating the dots where streets were plentiful, leaving the dots out of undeveloped areas.

Admittedly the approximate distribution of people shown on the 1960 population dot map of Figure 14 is not today's situation. To represent today's situation would require a similar map based on 1965 population data. No such data were available to us, and it was not feasible for this study to develop the missing information. While the 1960 data shown are not up to date, in the absence of something better they can serve usefully for planning protection. Recall that the population added to the City by annexation since 1960 is included in the map as drawn (since we have not limited ourselves strictly to the population within the irregular city limits of San Jose). So Figure 14 is deficient only in not showing the residential population added to the Santa Clara Valley since 1960. And that deficiency is one of detail, involving chiefly the outlying districts around the Almaden region, Blossom Hill Road, and to the west of Campbell. Because our street map is more recent than our population data, some of our outlying regions are shown with fewer people than they in fact have at the present time. These discrepancies do not significantly affect the downtown or the major central area of San Jose, since the populations there have not changed much since 1960. Since the outlying regions are generally without adequate NFSS shelter even in 1960, we have to solve that kind of problem in any case. If we had a 1965 population distribution, it would merely require more of the same solution we evolve for the 1960 outlying regions.

The approximate 1960 distribution of people shown on the opposite page is one of our starting points. These are the people to be protected by the area-wide shelter systems of this study. The map shows where and how many they are. Virtually all of them must be moved from the residential positions shown to some other place offering better physical protection from nuclear weapons effects.

RESIDENT POPULATION DISTRIBUTION OF SAN JOSE (1960) AND CEN




CENSUS TRACTS
A-1
A-2
A-7
A-8
A-9
A-10
A-11
A-12
A-13
A-14
A-15
A-16
A-17
A-18
A-19
A-23
A-24
A-25
A-29
A-30
A-31
A-32
B-33
B-34
B-35
C-36
C-37
C-39
C-40
C-41
S-120
500 People

City of San Jose Plan for Utilizing Public Fallout Shelters

The San Jose Office of Civil Defense (in cooperation with the Office of Civil Defense, Department of Defense) has prepared a one-sheet "Public Fallout Shelter Assignment Map" for the City of San Jose (dated 1964). It gives specific instructions for going to shelter from any part of the City.

To facilitate those instructions, the City was subdivided into 17 Disaster Districts, each consisting of several U.S. Census Tracts. (See preceeding page for Census Tracts.) The boundaries of those SJCD Disaster Districts are shown on the facing page.

The Disaster Districts also serve as subdivisions of the City of San Jose Civil Defense organization. Each has an identifying number and its own separate headquarters. The emergency communications of the City net includes links connecting the EOC and the Disaster District headquarters, and between the different Disaster District headquarters. There are other links between each Disaster District headquarters and the shelters within its Disaster District.

The Disaster Districts are useful subdivisions of the City for protection purposes and will be so used by this study. When our requirements for data or planning necessitate the breaking down of San Jose into smaller units of area, the units to be used will be either the SJCD Disaster Districts or the (somewhat smaller) US Census Tracts.

City of San Jose General Instructions for Nuclear Attack

Included with the "Public Fallout Shelter Assignment Map" of the City of San Jose are some general instructions for the public. These are reproduced below. They give the Standard Operating Procedures for nuclear emergencies, and will be taken to be applicable to this study unless otherwise noted.

GENERAL INSTRUCTIONS

PUBLIC WARNING SIGNALS

Two kinds of attack warning signals will be sounded on Civil Defense sirens, horns and whistles·

1. The Alert Signal (Attack Probable) is a three-to-five minute steady blast
2. The Take Cover Signal (Attack Imminent) is a three-minute wailing or warbling tone, or a series of short blasts

Public warning devices will not be sounded to indicate All Clear The All Clear Signal will be disseminated to the public by all other available means of communication.

ALERT SIGNAL

UPON RECEIPT OF THE ALERT SIGNAL, YOU SHOULD:

1. Turn on your radio, preferably battery operated, and tune to the Emergency Broadcast Station KXRX, 1500 on the AM dial to receive instructions
2. Do not use the telephone Lines should be left open for official calls
3. Walk to the nearest assigned Public Shelter with necessary supplies such as water, food, blankets and special medicines, and remain there until further instructions are received
4. If there is no assigned shelter for your area, or you are unfamiliar with local plans take the best available refuge, or improvise shelter, using whatever material is at hand, and follow instructions of local authorities

TAKE COVER SIGNAL

Upon receipt of the Take Cover Signal, you should expect an immediate attack.

1. If you are close to a shelter, go there and take cover.
2. If you are at home, and no prepared shelter is available
   a. Take cover in the basement
   b. If the home has no basement, stay toward the center of the house in the room or hall that will put as many walls as possible between you and the outside.
   c. Stay away from windows.
   d. Tune your radio to Emergency Broadcast Station KXRX, 1500 on the AM radio dial.
3. If you are in a car stop and take cover in a culvert, underpass, cave or ditch, If no such shelter is available, you should stay in your car, roll down the windows to equalize pressure, crouch or lie down below the level of the windows and protect your face, head and neck with your arms
4. If you are in the open and cannot reach shelter quickly, you should lie face down on the ground and cover your head with a coat or similar material
5. Do not use your telephone

ATTACK WITHOUT WARNING

A nuclear attack could come without warning If a brilliant flash occurs, quick action could save many lives

1. If you are outside, lie down in a curled position facing away from the direction of the flash and away from loose or breakable objects Seek the lowest, most protected spot, such as a ditch, gutter or other depressions
2. If your are inside, dive under or behind the nearest desk, table, sofa or other heavy furniture Lie in a curled position, facing away from windows.
3. You should remain in a protected position for not less than five minutes following flash, or until the blast wave has passed.

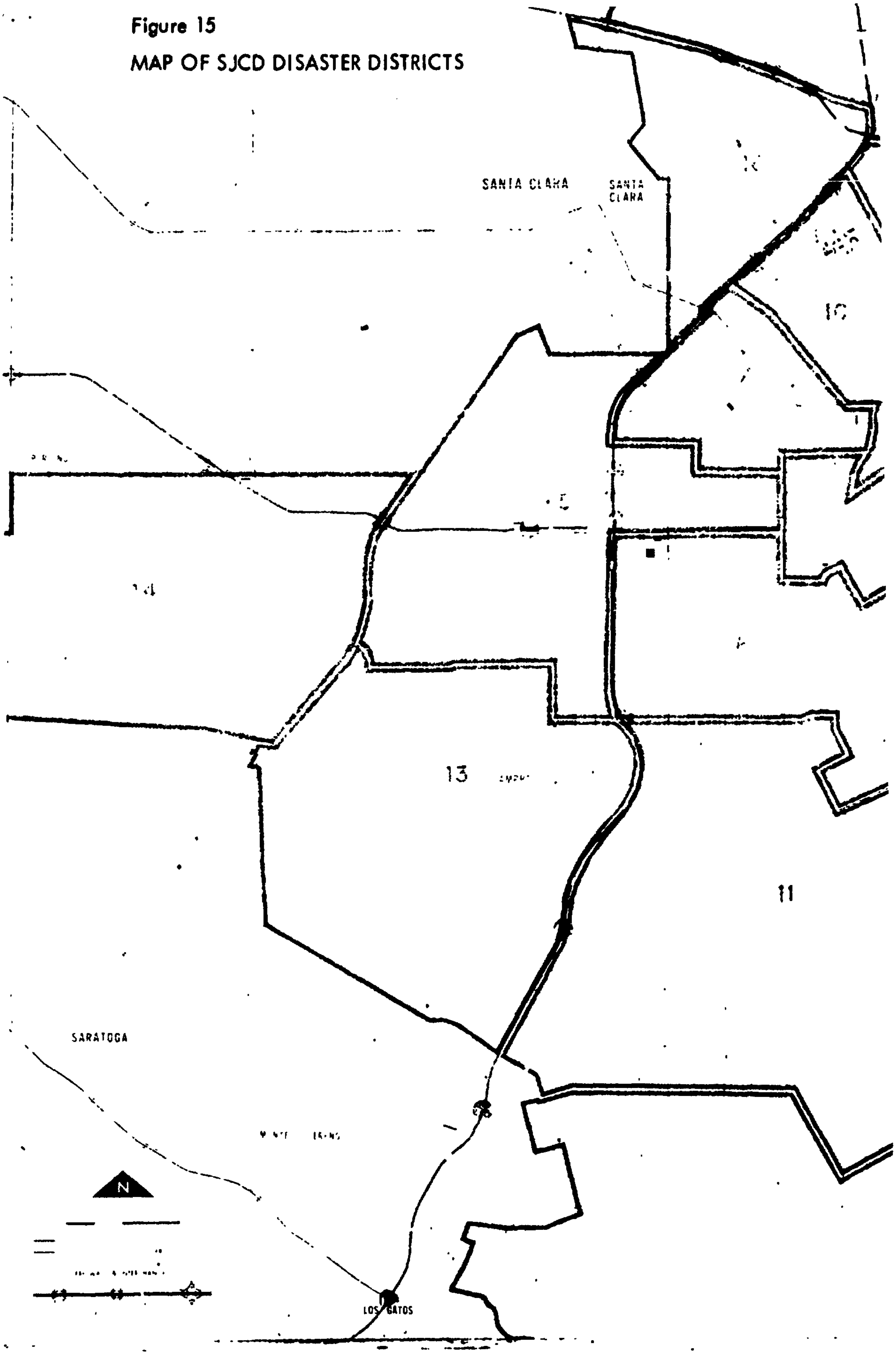
ACTION AFTER ATTACK

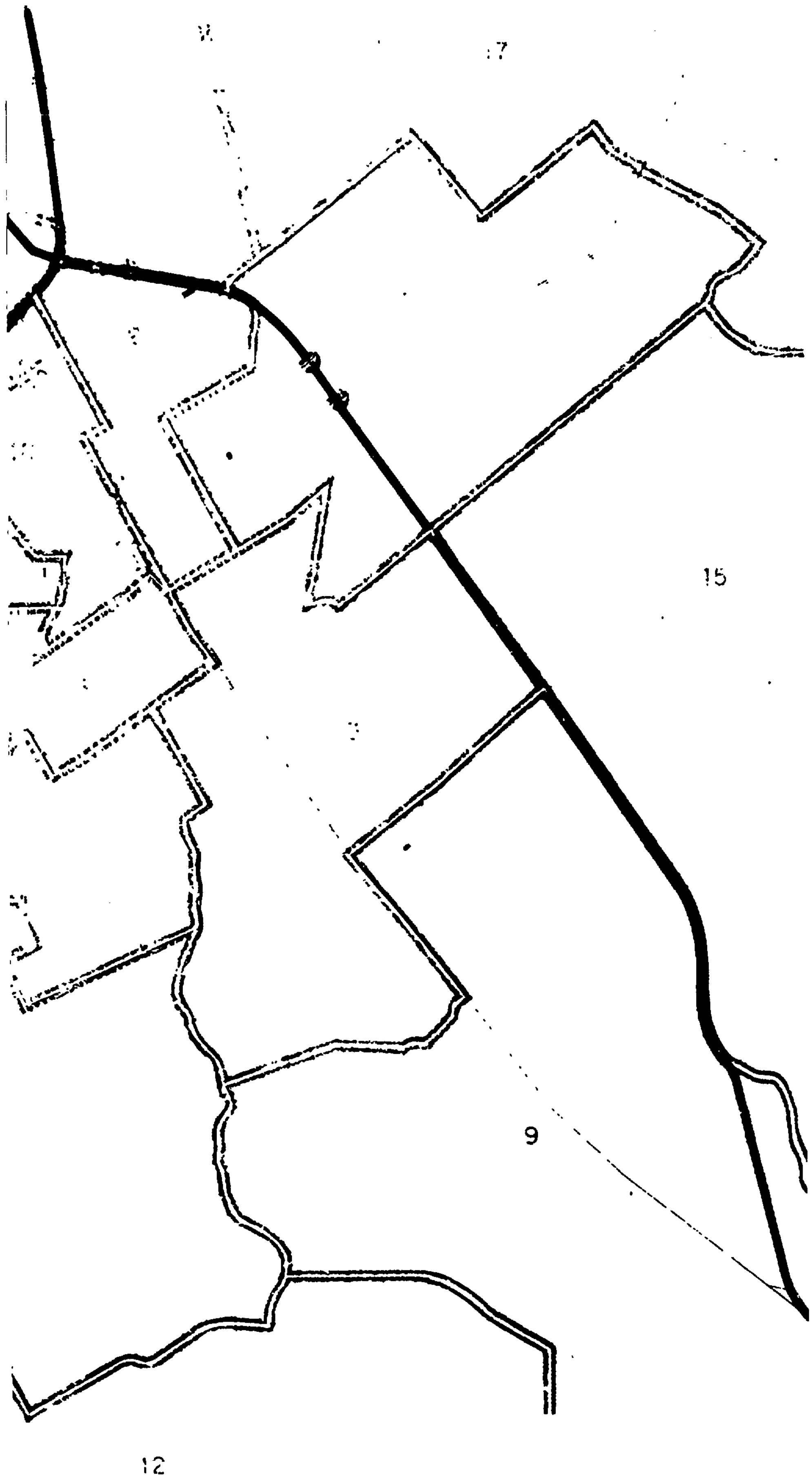
The danger of serious injury is not over, even though an attack has passed. Contamination by fallout is possible without visible evidence of moisture or dust.

1. You have at least 30 minutes to improve your present shelter or go to a better shelter before fallout arrives
2. Remain in your shelter or refuge until you are notified that it is safe to come out.
3. If you stay in your home, keep the house closed tightly as possible. If windows or doors have broken, nail blankets or other heavy material over them
4. If you were exposed in the open after the explosion, it is advisable to wash thoroughly, including your hair, and change clothing.

Figure 15

MAP OF SJCD DISASTER DISTRICTS




15
9
12

General Assumptions about Movement to Shelter

Plans for going to shelter or to emergency shielding in San Jose will be based on movement by foot, and generally along streets or sidewalks. Cross country walking may be feasible for some, but we will not count on it. People attempting to move to shelter in automobiles or other conveyances--although contrary to the SJCD General Instructions (see previous page)--are assumed to do as well or better than those walking all the way. (If for any reason their progress drops below the movement possible on foot, it is assumed they leave their mechanized transport and walk.) It is presumed that uncontrolled traffic jams or mandatory stopping of automobiles may occur, completely immobilizing many cars. However, it is assumed that such jams will not significantly inhibit the preattack movement by walking of either the former car occupants or others already moving on foot.

The movement of primary interest here is from residence to shelter; and it takes place in advance of nuclear attack, before there is any blast/fire damage to transportation routes, vehicles or facilities. Possible barriers to such movement are impassable terrain, waterways, heavy automobile traffic, and fenced freeways. Since there are no impassable land features in San Jose, this possibility can be eliminated at once. As to waterways, the Santa Clara Valley and San Jose are laced by several sizeable rivers and creeks. The gullys in which they run are not readily negotiated except where they are bridged. Fortunately, the major thoroughfares cross over these stream beds on adequate bridges. Since the NFSS Public Fallout Shelters also tend to be on major thoroughfares, one finds little or no lack of bridges to prevent or inhibit people from reaching shelter.

Heavy Traffic as a Potential Barrier

SJCD instructions call for walking to shelter. If that pedestrian movement is hindered or threatened by rapidly moving dense automobile traffic, police or volunteer civilians will have to stop the cars and allow the people on foot to proceed to shelter.

> Where necessary for adequate pedestrian movement, cars must be stopped or their movement controlled on any street, except the fenced freeways which traverse the City. (The intent is to leave freeway traffic unhindered if possible.) Suitable procedures and prior training to accomplish this essential traffic control may have to be an integral part of any plan for using area-wide shelter systems. It should be included in Readiness.

Fenced Freeways as Potential Barriers

At Overpasses without Interchange: This is the best place to cross freeways, as the access is unaffected by freeway conditions.

At Overpasses with Interchange: Subject to being jammed by automobiles trying to get on or off the freeway. Second choice for crossing purposes.

At Interchanges with No Overpass: Freeway traffic in an emergency is likely to make crossing difficult.

Between Crossing Points: Freeways cannot be readily crossed because of (1) the high steel wire fence on both sides and (2) the traffic during emergencies.

Conclusion

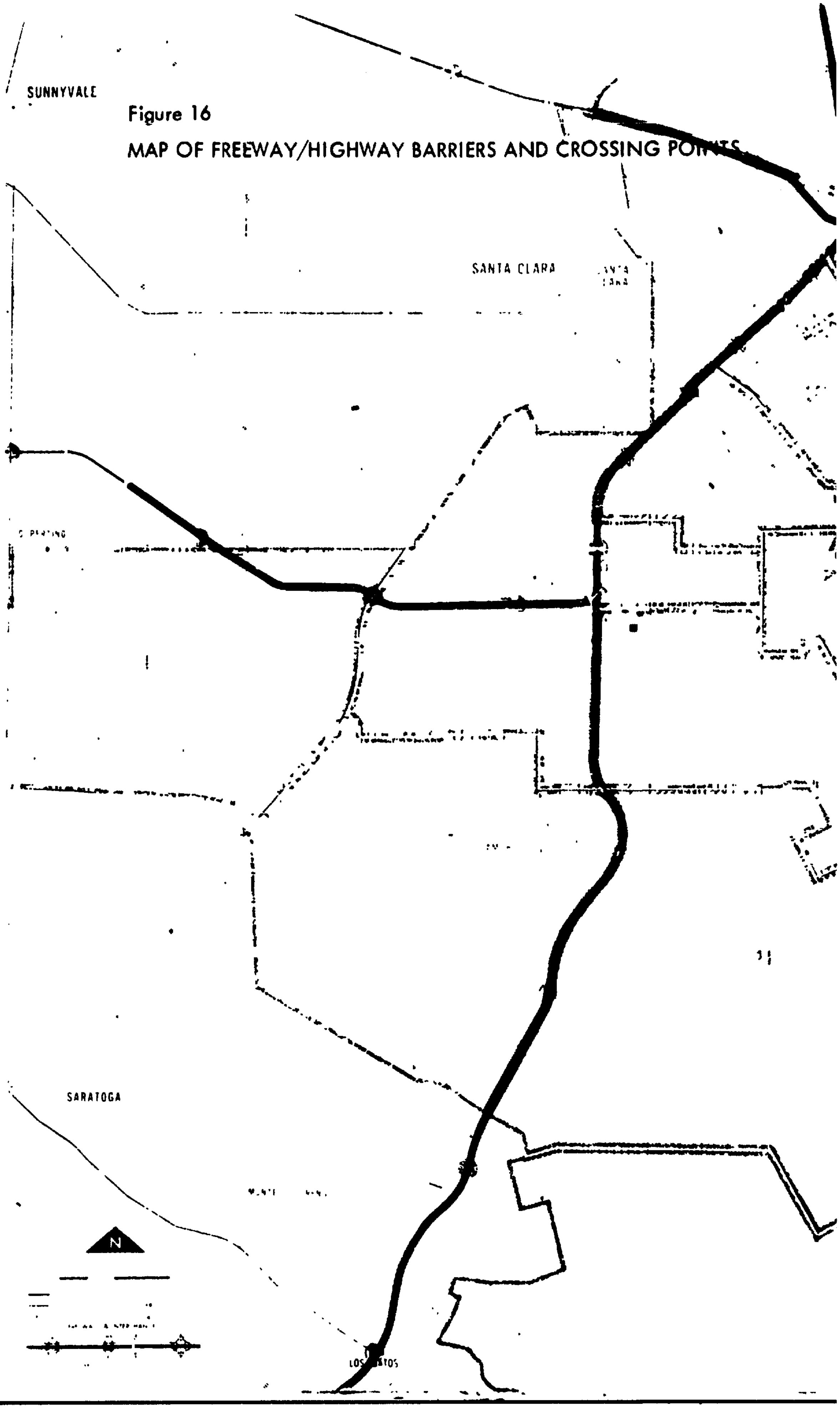
Assuming non-freeway automobile traffic is controlled as necessary for prompt pedestrian movement to shelter, the principal barriers to emergency movements in San Jose are the fenced freeways. These man-made obstacles prevent people from crossing except at selected points. The freeways involved and suggested crossing points are shown on the facing page.

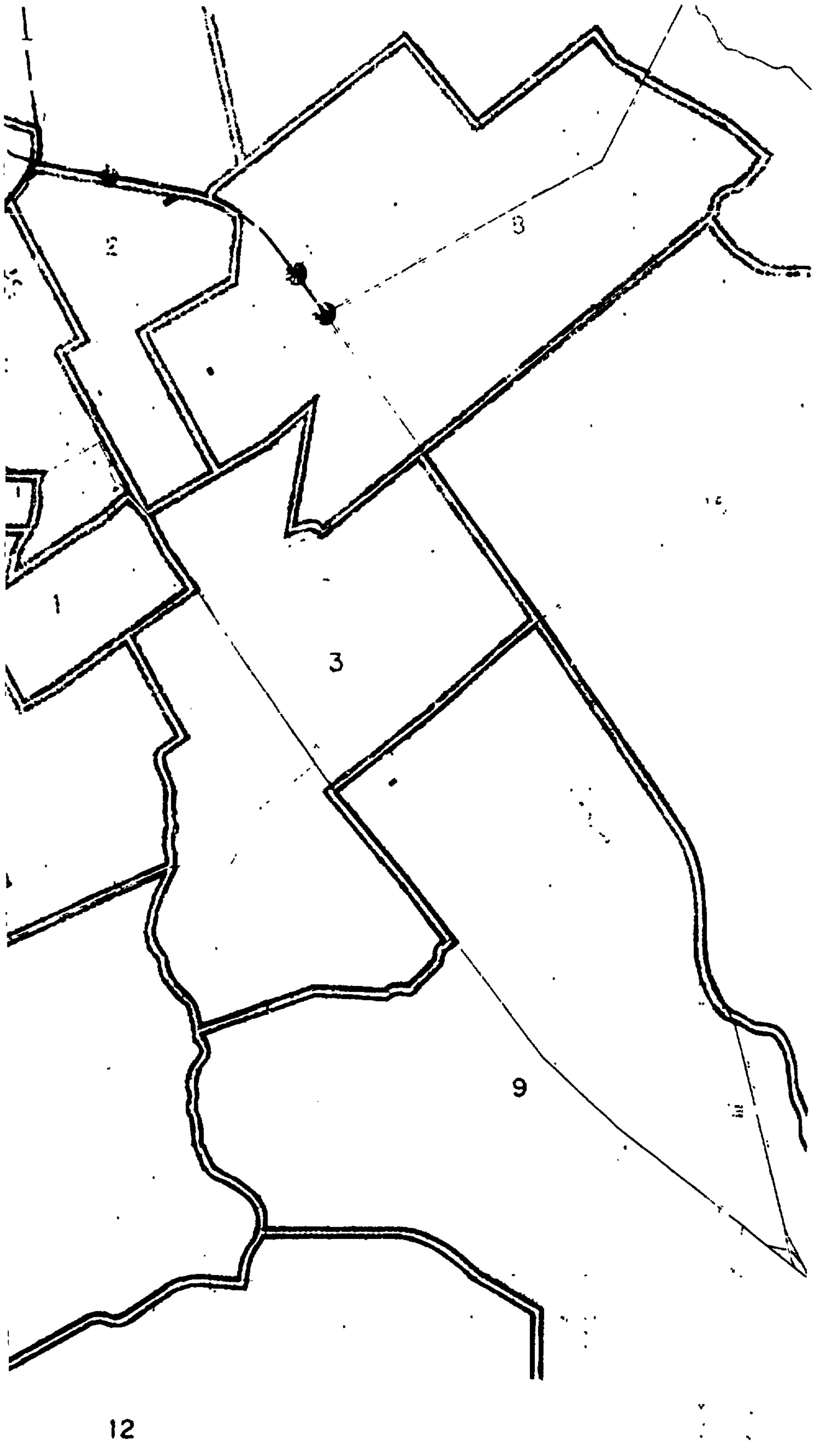
Freeway/highway barriers of this kind affect eight Disaster Districts when movement is according to SJCD Shelter Assignment. This blockage is not expected to be serious, however, as places to cross do exist (as shown on the map), not everyone has to make the crossing, and those that do will generally already know the streets to use to get across.

> Freeway/highway crossing points are real but not necessarily serious constraints on movement in San Jose.

Figure 16

MAP OF FREEWAY/HIGHWAY BARRIERS AND CROSSING POINTS




2
3
1
3
9
12

NFSS BASEMENT SHELTERS FOR SAN JOSE

We have seen where the people are who need protection, and we have noted the principal barriers that may impede their movement to protective shelter. Now (and for several pages to come) we would examine where the protective shelters are in San Jose. Note that shelter should be protective against the nuclear weapons effects anticipated. Since San Jose is assumed to be a Direct-Effects Region, subject to flash/blast/mass fire/fallout, we would do well to select shelters offering as much protection from those effects as possible. (And as shown in the previous chapter, to be really protective the shelter must provide Universal Protection--protection against all those nuclear weapons effects.)

The source of information about potential shelters within a given community is the National Fallout Shelter Survey (NFSS). In particular the Phase 2 Printouts of that survey contain the most useful tabulation of ordinary buildings and special facilities with spaces suitable (or nearly suitable) for fallout shelter. Of those total spaces, we consider here for possible use in Direct-Effects Regions only the ones belowground.

Our attention is limited to basement shelters for San Jose (Direct Effects) because they generally offer protection against blast and mass fire which is qualitatively superior to similar spaces aboveground. Aboveground structures experience far greater blast forces and are intrinsically much weaker than belowground basements. And aboveground spaces are more susceptible to flash ignition and to the spread of fire and fumes. Fallout shelters aboveground and in ordinary buildings are considered too dangerous to use for protection in Direct-Effects Regions.

We show then on the opposite page the approximate locations of the NFSS Basement Shelters. Those shelters which are near each other have been grouped together by San Jose Civil Defense into Shelter Complexes, and each Shelter Complex has been given a Complex number. The individual basement shelters making up each Complex are listed alongside by Facility Number. The Facility Number was assigned by the NFSS. For the actual locations of basement shelters in downtown San Jose, see the larger scale map of Figure 46. The capacities of each basement shelter according to the NFSS are listed in the accompanying table.

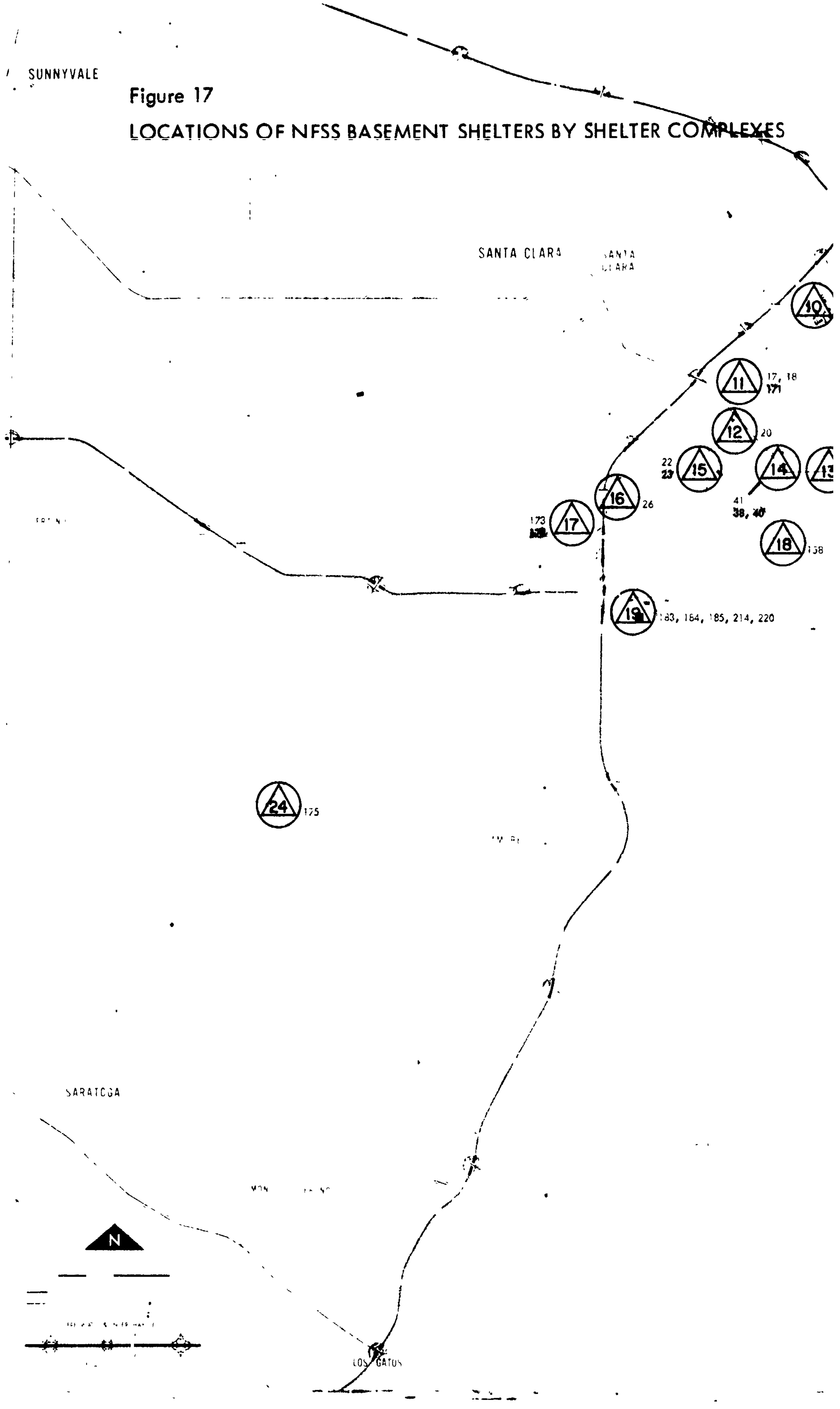
Table 2

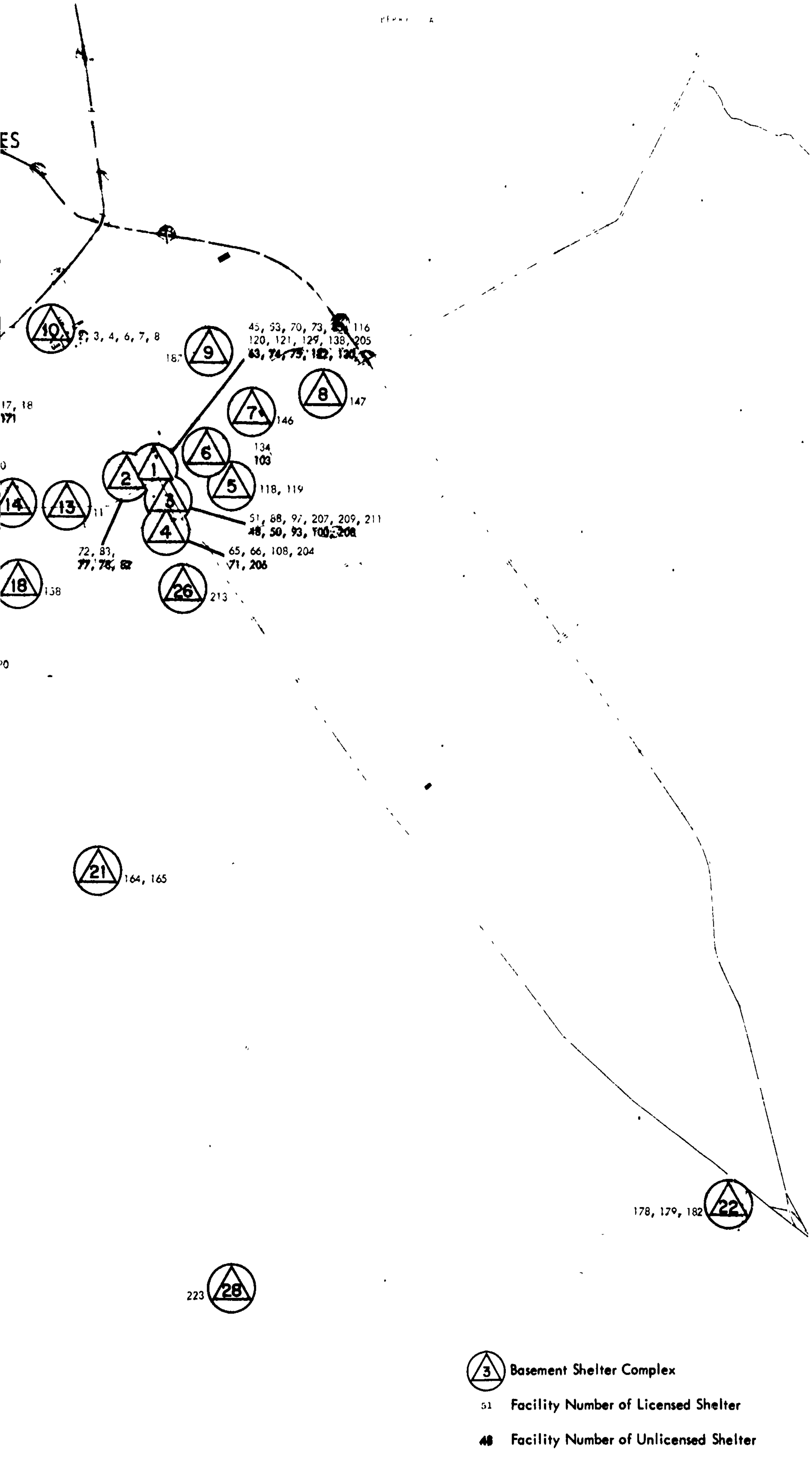
NFSS CAPACITIES OF SHELTER COMPLEXES FOR DIRECT EFFECTS

	FACILITY NO.		BASEMENT CAPACITY		
COMPLEX	LIC.	UNLIC.	AS IS	VENT ADDED	TOTAL
1	45		497	745	1,242
	53		364	0	364
		63	85	455	540
	70		704	1,589	2,293
	73		236	818	1,054
		74	332	0	332
		75	54	176	230
	85		50	200	250
	116		400	1,141	1,541
	120		178	632	810
	121		136	408	544
		122	88	463	551
	129		92	203	295
		130	119	193	312
	138		/	53	53
	205		1,155	0	1,155
	TOTAL		4,490	7,076	11,566
TOTAL LICENSED			3,812	5,789	9,601
TOTAL UNLICENSED			678	1,287	1,965
GRAND TOTAL			4,490	7,076	11,566
2	72		206	646	852
		77	138	346	484
		78	55	-	55
		82	77	-	77
	83		115	366	481
	TOTAL		591	1,358	1,949
TOTAL LICENSED			321	1,012	1,333
TOTAL UNLICENSED			270	346	616
GRAND TOTAL			591	1,358	1,949

Figure 17

LOCATIONS OF NFSS BASEMENT SHELTERS BY SHELTER COMPLEXES




ES
10
3, 4, 6, 7, 8
9
187
45, 53, 70, 73, 116
120, 121, 129, 138, 205
8
147
7
146
6
134
103
5
118, 119
1
2
3
51, 88, 97, 207, 209, 211
4
65, 66, 108, 204
71, 206
72, 83,
77, 78, 82
14
13
17, 18
18
26
213
21
164, 165
22
178, 179, 182
28
223
3
Basement Shelter Complex
51
Facility Number of Licensed Shelter
48
Facility Number of Unlicensed Shelter

NFSS BASEMENT SHELTERS, VENTILATION ADDED

The building Facility Numbers in the table of NFSS basement shelter capacities appear in one of two columns depending on whether the space has been "licensed" or is as yet "unlicensed" for use as public shelter in an emergency.

The "As Is" capacity is the number of people who could be sheltered in the basement as it now stands, based on certain ground rules specified for the NFSS as to available ventilation or volume of air.

Phase 2 of the NFSS also included engineering estimates of the additional people who could be sheltered if substandard ventilation were augmented with additional equipment. These estimates apply particularly to basements and are reproduced for San Jose basement shelters in the next to the last column, under the heading: Ventilation Added. The final column of basement capacities is the sum of the "As Is" and the "Vent Added" capacities.

The table entries show that significant increases in shelter capacity could be obtained in the identified San Jose basement shelters if the Phase 2 ventilation were to be implemented. Two approaches have been suggested by the Office of Civil Defense (OCD) for providing this increased flow of air:

1. Installing emergency motor generator sets and the necessary fans/blowers and ducts in the shelter space.

2. Storing standard Package Ventilation Kits (PVK) in shelter (along with the present Federal stocks), to consist of manual/electrical-power driven fans and reinforced plastic ducts tailored to the given basement shelter.

The table shows several values for the total capacity of each Shelter Complex, depending on whether use is made of both licensed and unlicensed shelters, or of just those that are licensed; and depending on whether the basements are used "As Is" or with augmented ventilation.

TABLE 2 (Continued)

	FACILITY NO.		BASEMENT CAPACITY		
COMPLEX	LIC.	UNLIC.	AS IS	VENT ADDED	TOTAL
3		48	84	442	526
		50	101	391	492
	51		173	551	724
	58		50	-	50
	88		286	1,148	1,434
		93	131	598	729
	97		280	1,002	1,282
		100	95	431	526
	207		64	0	64
		208	98	396	494
	209		288	180	468
		211	58	0	58
	TOTAL		1,708	5,139	6,847
TOTAL LICENSED			1,141	2,881	4,322
TOTAL UNLICENSED			567	2,258	2,825
GRAND TOTAL			1,708	5,139	6,847
4	65		345	1,383	1,728
	66		129	331	460
		71	74	-	74
	108		1,971	0	1,971
	204		359	0	359
		206	148	600	748
	TOTAL		3,026	2,314	5,340
TOTAL LICENSED			2,804	1,714	4,518
TOTAL UNLICENSED			222	600	822
GRAND TOTAL			3,026	2,314	5,340
5	118		50	0	50
	119		513	1,026	1,539
	TOTAL		563	1,026	1,589
6		103	162	0	162
	134		84	340	424
	TOTAL		246	340	586
TOTAL LICENSED			84	340	424
TOTAL UNLICENSED			162	0	162
GRAND TOTAL			246	340	586

TABLE 2 (Continued)

COMPLEX	FACILITY NO. LIC.	UNLIC.	BASEMENT CAPACITY AS IS	VENT ADDED	TOTAL
7	146		723	0	723
8	147		300	750	1,050
9	187		50	0	50
10	2		416	384	800
	3		200	254	454
	4		324	1,289	1,622
	6		193	1,017	1,210
	7		85	392	477
	8		322	1,023	1,345
	TOTAL		1,540	4,368	5,908
11	17		60	277	337
	18		61	245	306
		171	60	0	60
	TOTAL		181	522	703
TOTAL LICENSED			121	522	643
TOTAL UNLICENSED			60	0	60
GRAND TOTAL			181	522	703
12	20		134	656	790
13	11		760	3,020	3,780
14		38	106	234	340
	40		52	-	52
	41		120	0	120
	TOTAL		278	234	512
TOTAL LICENSED			172	0	172
TOTAL UNLICENSED			106	234	340
GRAND TOTAL			278	234	512

TABLE 2 (Continued)

COMPLEX	FACILITY NO. LIC.	UNLIC.	BASEMENT CAPACITY AS IS	VENT ADDED	TOTAL
15	22		70	74	144
	23		182	-	182
	TOTAL		252	74	326
16	26		1,328	2,128	3,456
17	173		8,814	20,568	29,382
		174	215	685	900
	TOTAL		9,029	21,253	30,282
TOTAL LICENSED			8,814	20,568	29,382
TOTAL UNLICENSED			215	685	900
GRAND TOTAL			9,029	21,253	30,282
18	158		260	373	633
19	183		214	760	974
	184		187	165	352
	185		774	2,215	2,989
	214		361	0	361
	220		308	1,042	1,350
	TOTAL		1,844	4,182	6,026
21	164		62	0	62
	165		70	0	70
	TOTAL		132	0	132
22	178		113	181	294
	179		138	240	378
	181		59	0	59
	182		561	2,103	2,664
	TOTAL		871	2,524	3,395

No claim is made here that the NFSS Basement Shelters in San Jose, as they are or with additional ventilation, will withstand all the nuclear weapons effects in Direct-Effects Regions--even in small doses. They do not presently provide Universal Protection (even low grade) for lack of an adequate resistance to mass fire. However, no other existing buildings are as good, so we put them high on our list for lack of anything better.

Reinforced concrete basements (preferably entirely below grade and without doors or windows in the exterior walls) generally do offer excellent protection from flash burns, fair protection from blast, and good protection from radioactive fallout. Their prime deficiency lies in their inability to protect their occupants from the effects of a mass fire in their vicinity, including the burning of the parent building above (or its combustible contents). However NFSS Basement Shelters are believed to have the greatest potential of existing buildings for upgrading to Universal Protection (albeit low grade, e.g. protective at 2 to 5 psi).

The upgrading of reinforced-concrete basement fallout shelters against fire and blast for protection against direct effects is the subject of a special report, to which the reader is referred.* In that report it is shown that the contents of such shelters are threatened by ordinary fires primarily through just the vertical openings in the ceiling, and eventually by the failure of the ceiling itself. These vulnerabilities may be rather readily reduced (at least in principle) by fairly simple preparations and procedures, and such upgrading may be sufficient except, perhaps, in the regions of firestorms. At this time it seems desirable to avoid possible firestorm areas as places for shelter in ordinary buildings (especially in San Jose where the potential firestorm area is quite limited). As the referenced report states (p. 15):

"Because we believe protecting people in identified basement shelters from the direct-effects fire from nuclear attacks of American communities (as they now stand) may be difficult at best, it seems prudent to restrict our initial efforts to regions where fire storms are unlikely to develop. Since the fire problem and the resulting temperatures are always presumed to be worse in a fire storm than in an ordinary mass fire, we would like to limit our first efforts to the lesser of the two evils and exclude from consideration for upgrading those identified basement shelters which are in areas capable of supporting a fire storm."

In the next chapter we will estimate that part of downtown San Jose where a firestorm could conceivably develop.

As detailed in the referenced report, upgrading the resistance of shelters to fire is based on keeping fire out of the reinforced-concrete basements by (1) eliminating internal shelter fire hazards, (2) preventing fire entry to shelter through openings in the ceiling and walls and (3) providing adequate fire suppression equipment in shelter. It appears practical to exclude fire from shelter.

Unfortunately this is not the end of the fire problem, for poisonous gases and noxious smokes from combustion may still find their way into the occupied parts of shelter in hazardous concentrations even though fire itself is excluded. Thus there arises the requirement <u>to provide breathable air</u> for the occupants of ordinary basements which have been vented (doors and windows blown out) by blast. This upgrading of shelter habitability is a necessary companion of the upgrading of the shelter structure against fire and blast. No simple low-cost method that is suitable for this essential function is known to this author, and if nonesuch exists this must surely be an area worthy of future OCD research.

If satisfactory fire resistance (including breathable air) can be incorporated into existing basement shelters, the next step upward in direct-effects protection is to increase their blast resistance. Reinforced-concrete basements will generally withstand 2 psi

* Richard I. Condit, <u>Concepts for Upgrading the Protection of Identified Fallout Shelters in Basements</u>, Stanford Research Institute for the Office of Civil Defense, October 1965.

peak overpressures as constructed. Their principal structural weakness is usually the ceiling, which may fail below 5 psi if the construction is not unusually strong. However, simple supporting columns can be added (temporarily or permanently) in between the integral ones already there to reduce the length of unsupported span and increase the strength of the shelter overall to at least 5 psi. Many of the principal NFSS Basement Shelters in San Jose have been inspected for their potential for upgrading to 2 and 5 psi. The general results showed this to be a reasonable procedure to consider to improve direct-effects protection. The detailed results are given in Appendix A.

As explained in the referenced report, further increases of blast resistance of existing basement shelters to 10 psi, 20 psi or beyond may bring in new difficulties caused by the general disintegration of the surroundings under these higher blast loads. While upgrading to 2 or 5 psi appears generally desirable, to go beyond to 10 psi or higher may be better done with special shelters newly constructed for that purpose and located in the interior of large open incombustible areas within the community (such as school grounds and parks)--away from built-up regions and severe difficulties from immobilizing blast debris (trapping people in and out of shelter) and hazardous fire fumes (poisoning shelter occupants).

TABLE 2 (Continued)

	FACILITY NO.		BASEMENT CAPACITY		
COMPLEX	LIC.	UNLIC.	AS IS	VENT ADDED	TOTAL
23	169		882	819	1,701
	170		400	0	400
	189		84	0	84
	216		745	1,584	2,329
	TOTAL		2,111	2,403	4,514
24	175		2,756	0	2,756
26	213		225	0	225
28	223		647	0	647
SJ TOTAL LICENSED			31,765	54,330	86,095
SJ TOTAL UNLICENSED			2,280	5,410	7,690
SJ GRAND TOTAL			34,045	59,740	93,785

TABLE 2

CONCLUSIONS:

1. Recalling that San Jose has about 320,000 people, the final totals in the table above show that only about 10% of the population can be sheltered in all the identified NFSS Basement Shelters as they are.
2. Improved ventilation could nearly triple the basement capacity, so that almost 30% of the population could be sheltered--a very substantial improvement!
3. With or without supplemental ventilation, much more shelter/shielding must be found or produced to protect the population of San Jose from the direct effects of nuclear explosions.

NOTE: A master list of NFSS Shelters is in Appendix A (with a key to the symbols used above).

SPECIAL FACILITIES FOR SHELTER

National Fallout Shelter Survey

No "Special Facilities" (i.e. mines, caverns, subways, storage-types, underpasses, basement extensions, and other underground facilities) of value for protection were found in the Phase 2 Printouts of the NFSS for the City of San Jose. A check with the files of San Jose Civil Defense revealed a small number of Special Facilities, but their aggregate capacity was so small that they did not seem worth considering further.

Hudson Institute, Inc., Evaluation for OCD

In a report published recently* R. A. Krupka attempted to compile for OCD the existing information about the shelter potential of mines, caves and tunnels. That report was examined for mine, cave and tunnel locations in the counties of San Mateo, Alameda, Santa Clara, and Santa Cruz (i.e. within a 40-50 mile radius of San Jose). No caves or tunnels were reported for these counties but 3 mine locations were reported as follows: (1) Alameda County--Telsa Mine, 12 miles south of Livermore, 192 spaces; (2) Santa Cruz County--San Vincente Mine, 5 miles east of Davenport (about 25 miles south of San Jose) 2377 spaces; and (3) Santa Clara County--Magnesite Mines, Red Mountain (about 30 miles NE of San Jose via mountain road) 2116 spaces. Because of their distance and relatively low capacities, all three of these mines appear inappropriate for San Jose Civil Defense--even for long-time warning. Consequently this particular report contributes no mine, cave or tunnel locations important to San Jose.

Preliminary Investigation of Local Mines as Shelter Possibilities by this Study**

The coverage of mines in the above report was limited to limestone, salt and gypsum/sandstone, because those types of mines yield the soundest structure for shelter as a consequence of their mining methods. However, the Hudson Institute report leaves open other mining possibilities, such as coal, gold, etc. Thus a possibility yet remains, to look into mines not covered by previous surveys. From a study of the mining history of Santa Clara County*** the most likely mine to investigate was selected, the New Almaden quicksilver mine. That mine is the largest in the County and close to San Jose, about 12 miles from city center. See the map on the facing page.

A review of existing reports and maps**** indicated many miles (over 10 miles) of tunn ls above the 800 foot level, the lowest level open to the side of the hill and relatively well ventilated. In addition to the large quantity of "well ventilated" tunnels, large stopes were indicated, useful for providing reserve air. This information suggested that here might be a protective resource of very large capacity, maybe accommodating as many as 50,000 people. Further investigation at the site of the mine revealed a much less optimistic picture. Mr. Clyde Dean of the Thornburg Mining Co.***** (new owners of the New Almaden Mines) said nearly all tunnels, adits and stopes were in bad condition, i.e. unsuitable for mining and/or shelters. Detailed information about conditions in the mine can be obtained either by visiting the mine or from Jimmie Schneider****** the mine historian. The story is not ended, however, because it appears that the mines will be reopened soon. As mining progresses the tunnels will be renovated and should thereby become safe for use as emergency shelters. The caved stopes will probably not be renovated, but they will still supply a reserve quantity of air for breathing. It is conceivable that a coordinated effort between mine owners and SJCD authorities--as the mine is reactivated--could be advantageous to both and should result in economical and useful shelter space. It also seems that there is plenty of space available in the vicinity for parking vehicles used for transportation to the mine/shelter complex. This future shelter development possibility should not be lightly dismissed, because if successfully achieved it would improve the protection from both direct effects and radioactive fallout for the southern part of San Jose, a region which is well populated but without appreciable identified shelter at present.

See facing page for footnote.

Business News

New Almaden mine may yield quicksilver again

SAN JOSE (UPI) — The inactive New Almaden Mine, which once produced more than a third of the country's quicksilver, might soon be back in operation.

Engineers of the Thornberg Mining Co., Grand Junction, Colo., are reportedly exploring tunnels and testing ore at the mine, located in the foothills of the coast range near here.

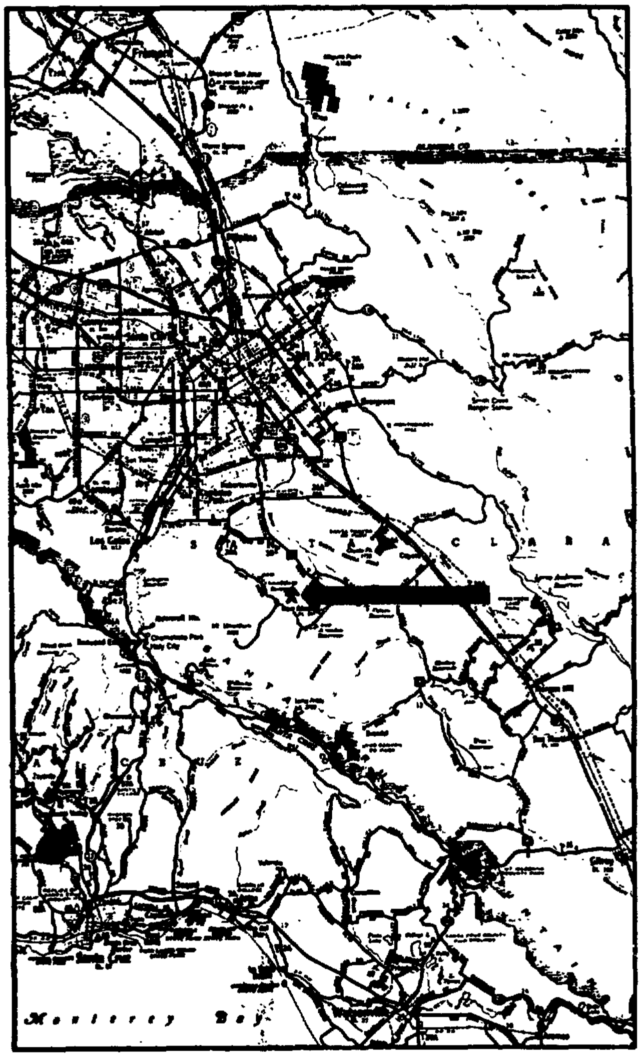
The company has held an option on the mine for six months but spokesmen say they have "no statement at this time."

The mine was worked for silver more than 20 years before the gold rush of 1848. In 1845 cinnabar, the principal source of quicksilver, was discovered in its tunnels.

Between 1941 and 1948, the mine produced more than one third of the country's quicksilver, according to a 1961 United States Geological Survey.

Figure 18

LOCATION OF NEW ALMADEN MINES: SUGGESTED FOR LONG TERM DEVELOPMENT AS LARGE CAPACITY SHELTER FOR SAN JOSE RESIDENTS



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* Robert A. Krupka, An Evaluation of the Shelter Potential in Mines, Caves and Tunnels, Hudson Institute, Inc., report HI-507-RR for the Office of Civil Defense, June 11, 1965.

** Prepared by Bernard L. Gabrielsen of SRI.

*** "Mines and Mineral Resources of Santa Clara County, California," California Journal of Mines and Geology, Vol. 50, No. 2, p. 320, April 1954.

**** "Geology and Quicksilver Deposits of the New Almaden District Santa Clara County," Geological Survey Prof. Paper 360, USGS, 1964.

***** Thornburg Mining Co., New Almaden Mines, P.O. Box 80, New Almaden, California.

****** Jimmie Schneider, 100 Ryland, Monte Sereno, telephone 293-2623.

EXISTING COVERED DRAINAGE FACILITIES FOR SHELTER

The protective resources of San Jose identified by the National Fallout Shelter Survey and potentially useful for direct-effects protection have now been exhausted. A rough accounting may be in order. Ignoring the long-term future possibility of the New Almaden Mines, we have at most mentioned identified shelter spaces capable of holding 93,785 people at normal design occupying densities (10 sq ft/person). If reduced space by a factor of 2 is allowed (5 sq ft/person), those same identified shelters would accommodate 187,570 persons. And this for a population of 204,200 (1960) or 317,000 (1965). Thus even if we use everything that has been noted as available shelter, and compact by a factor of 2, and assume all spaces are close enough to people to be occupied soon enough, it is apparent that we do not yet have in mind enough shelter for the population involved. Since we have exhausted the possibilities provided by the NFSS, from here on we are on our own. What other physical protection from direct effects can be found or developed in San Jose? Attempts to answer that question will fill the next several pages.

As noted briefly in the last chapter, there is the possibility of covered drainage facilities big enough for people to get into for protection: large buried culverts of rectangular boxes, and round or oval pipes. Recall that appreciable rain normally falls in this region only during the months from November through April. Thus for six months of the year the drainage facilities are practically dry and unused. Moreover the total rainfall is only about 15 inches, and this occurs sporadically so that even during the rainy season there is not much water running in the drainage facilities except during and immediately after actual rain storms. Considering the entire year, one could find emergency shelter in the drainage facilities of San Jose almost any time with only a small risk of being driven out by excessive runoff water.

The map on the facing page shows the man-sized enclosed (and buried) culverts, greater than 5' in diameter, that presently exist in or near San Jose. These culverts provide Universal Protection: protection against flash, blast, mass fire, and fallout. Protection against flash is good, against blast is fair, against mass fire is good, and against fallout is good. In general, the effects of blast are expected to determine the casualties among people taking emergency shelter in buried culverts.

The number and letter on the map near each culvert are for identification. In the accompanying table one can find the size and length of each run of buried culvert from this identifying number. Approximate capacities for each run are also listed. These are based on 10 sq ft/person for rectangular box culverts, and on 6 lineal ft/person for round or oval pipes. (It is tacitly assumed that ventilation within the culvert does not limit capacity, although this would have to be evaluated for specific culverts.)

Note that the total amount of this potential emergency shelter in San Jose is substantial--and it is Universal Protection (and already out there and paid for).

* * * * *

While buried culverts offer good protection from nuclear weapons effects, they are deficient on several other counts. (1) They are hard to get into--their access is poor--they frequently can be entered only at the ends and those ends may be barred or fenced off. Access could be improved by providing other portals for entry, and by making it possible to get into any portal quickly in an emergency. (2) They are unmarked and unknown to many people who might need to use them. If they are to be used they should be identified conspicuously, added into the area-wide shelter system, and publicized. (3) Their habitability is poor. They may be wet or partially filled with water, they may have insufficient ventilation, and they presently have no shelter survival/sanitation stocks. For the smaller pipes, even if Federal stocks were provided, it is not apparent how they could be utilized effectively in practice. Difficulties with personal sanitation seem likely to be especially trying.

* * * * *

Nevertheless, these culverts offer good protection, and perhaps if we work at it we can learn how to utilize them properly.

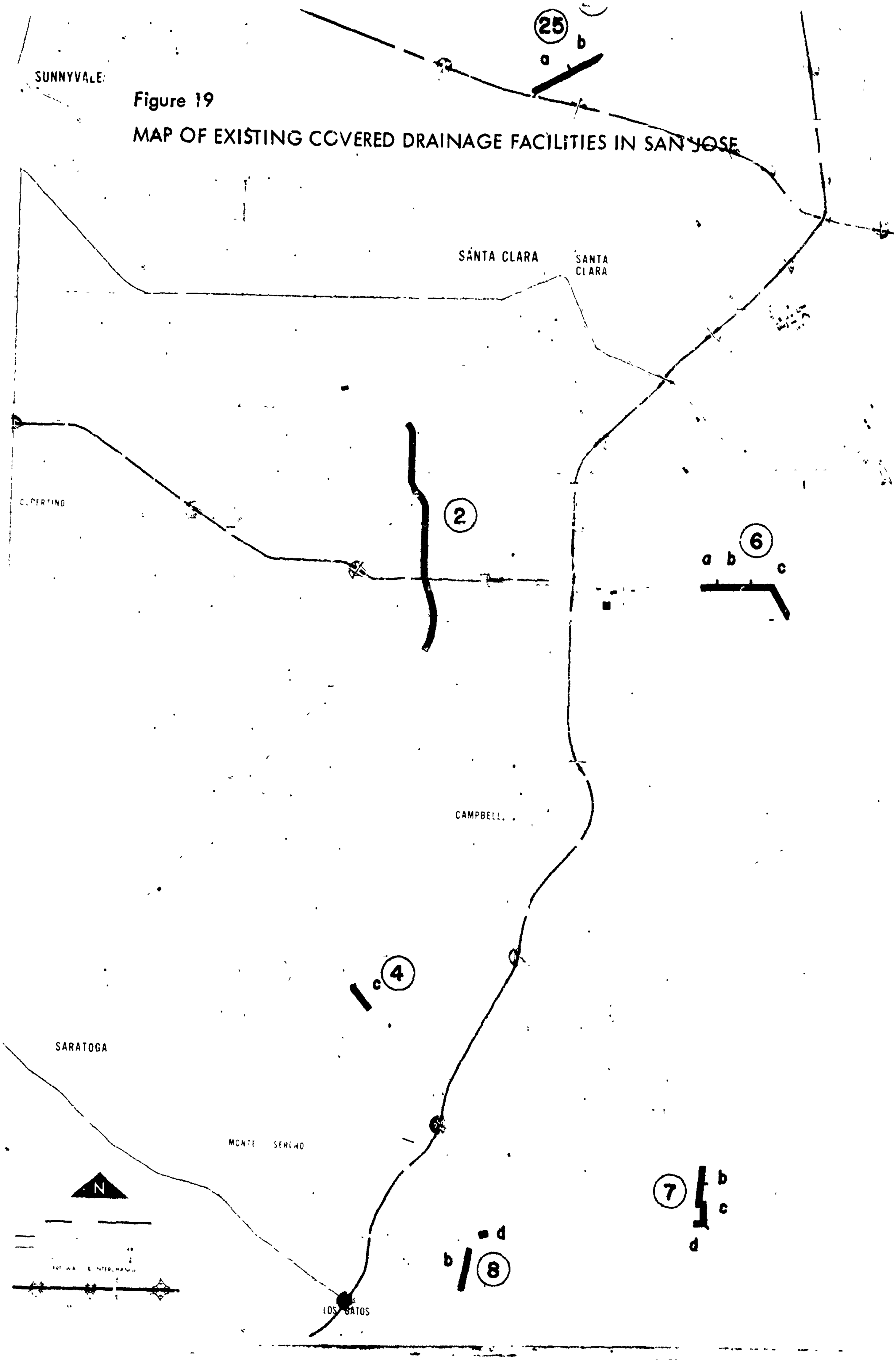
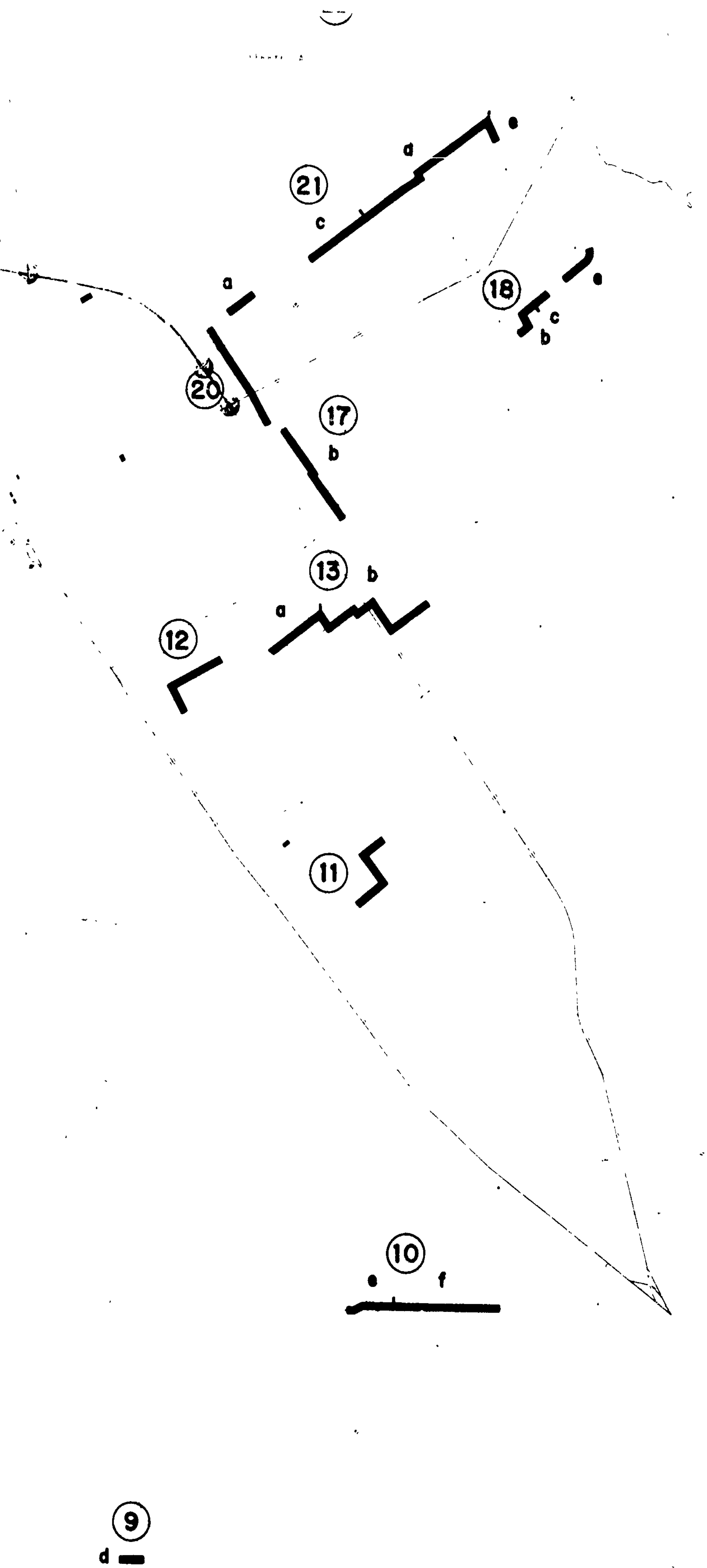


Figure 19

MAP OF EXISTING COVERED DRAINAGE FACILITIES IN SAN JOSE


21
a
c
e
a
18
e
c
b
20
17
b
13
b
a
12
11
10
e
f
9
d

Background

In the San Jose area there is something like an evolutionary scheme of drainage development. First the natural ditches and gullies take the runoff rainwater to the San Francisco Bay. Then as roads are constructed the natural ditches are modified and new water routes are added with storm drains and culverts. Then as more people come into the area their buildings and other improvements encroach onto the major gullies (creek- and riverbeds) until further erosion of the banks of those watercourses threatens to jeopardize those constructions. Then the banks of the creek or river are lined with concrete to stabilize their positions (and perhaps allow closer building). Lastly a new freeway is needed in the area, all the available land is developed and costly, so the creek or river is filled with a reinforced-concrete box culvert, the top of the culvert supports the roadbed, and the stream disappears from view and is replaced with a freeway--a freeway with a hidden hollow "basement" for carrying excess rainwater away. And as we have noted, that basement may also provide much needed protection from the effects of nuclear attack, be they direct effects or fallout.

San Tomas Aquino Expressway and Storm Drain

Our inspiration for this kind of thinking was the San Tomas Aquino Expressway. This facility was built in the San Jose area recently and corresponds to the last stage in the evolution outlined above. With no thought whatsoever for the fine passive protection from nuclear attack which would result, this reinforced concrete box 15 feet wide by 13.5 feet high was constructed nearly 2 miles long. More than 14,000 people can be sheltered if they can get in, and natural ventilation seems likely to be adequate. Their Protection Factor is more than the 500-1000 recommended for Direct-Effects Regions. Except at the very ends those inside will be adequately protected from flashburn, and the ends themselves are fairly well removed from sources of fire and the consequent poisonous gases and noxious smoke. There is nothing in the culvert itself that can or will burn. This one facility will hold more than 2/5 of all the people who could presently be sheltered in the culverts of San Jose. And they are well protected against everything but blast (and a severe downpour)--and even the blast protection is as good or better than they can generally get elsewhere at present. The structure itself should withstand the forces of blast pretty well; the people within, however, are rather exposed (with both ends open) and so are not well protected from the direct or secondary effects of blast: the sudden pressure changes on body organs, or the bombardment by airborne trash and the violent bodily displacements.

If the construction of the San Tomas Expressway could be justified for the dual purposes of community transportation and storm drainage, might not similar projects be possible for the triple purposes of community transportation, storm drainage and emergency shelter? The details of our study of the San Tomas Expressway are in Appendix B.

Table 3

CHARACTERISTICS OF EXISTING COVERED DRAINAGE FACILITIES FOR SHELTER

Facility Number	Size and Type	Length (ft)	Capacity*
2	15' x 13.5' RCB	9,500	14,200
4c	60" RCP	1,200	200
6a	60" RCP	600	100
6b	66" RCP	1,300	210
6c	72" RCP	3,000	500
7b	78" RCP	500	80
7c	72" RCP	2,200	360
7d	66" RCP	700	110
8b	60" RCP	1,800	300
8d	9' x 6' RCB	500	450
9d	60" RCP	700	110
10e	72" RCP	2,100	350
10f	60" RCP	5,400	900
11	60" RCP	4,200	700
12	60" RCP	8,000	1,330
13a	66" RCP	4,700	780
13b	60" RCP	11,300	1,870
17b	60" RCP	7,200	1,200
18b	78" RCP	3,300	500
18c	66" RCP	1,400	230
18e	60" RCP	2,200	360
20	6' x 5' BOX	9,700	5,800
21a	78" RCP	1,500	250
21c	72" RCP	5,500	910
21d	66" RCP	7,000	1,160
21e	60" RCP	600	100
22b	72" RCP	1,800	300
24	60" RCP	2,500	410
25a	66" RCP	2,300	380
25b	60" RCP	1,800	300
Total number of enclosed drainage facility spaces....			34,500

* Figures based on 6 linear feet/person for pipes; 10 square feet/person for boxes, and the assumption that present ventilation is adequate.

FUTURE NEW COVERED DRAINAGE FACILITIES FOR SHELTER

The protection from nuclear weapons effects which is possible through the use of large drainage culverts in arid or semi-arid regions is substantial. Since such public works improvements are still being built from time to time in regions which continue to grow and/or develop, it seems appropriate to consider influencing their initial design and construction to benefit civil defense. The goal might be twofold: In regions in need of shelter, (1) to make the new large buried culverts constructed even more suitable for passive protection, and (2) to stimulate the construction of additional new large buried culverts.

Toward Culverts More Suitable for Civil Defense

This is a problem of design. We have not solved it. We have pecked at it and leave for the record the following seeds:

1. Practical arrangements to reduce the nuisance of water flowing, or the hazards of water flooding the culvert seem desirable. Closing or blocking the upstream opening is one way. Blast doors or sand bags are possibilities. For lesser flows, a lower portion of the floor might be provided to keep minor amounts of water away from the occupants.

2. Blast protection of the occupants would be increased with permanent blast baffles (allowing water to pass freely) at the ends of the culvert to prevent airborne missiles hazardous to the occupants from entering. Blast doors (or their equivalent) at both ends would be required to increase the personal protection further. While these would appear to be incompatible with storm drain requirements, the continued functioning of storm drains in a nuclear emergency may not be important. Perhaps an upstream blast door could not only raise the personal blast protection but simultaneously lower the water level in the culvert. And such closures of the ends would make the flashburn protection excellent. Supplemental ventilation (with blast valves?) would probably have to accompany. If time allows, the crude equivalent of blast doors might be possible to build up with sand bags prepositioned nearby.

3. Blast resistance for the structure may be raised from about 5-8 psi overpressure to about 20 psi by minor additions of reinforcing steel to the walls in new construction.

4. Access should be improved. Occasional manholes and ladders for entry along the length of the long culverts may be useful. Emergency gates in protective fences at the ends may be helpful.

5. Ventilation may need to be increased. Possibilities include manually operated punkahs (hanging from eyebolts in the ceiling) or fans on the gutter inlets; or power-driven fans at one or both ends (must be protected from blast).

6. Storehouses or closets for emergency supplies should be provided. We do not know how these should be related to the culvert proper and its flooding.

7. To augment drinking water supplies some removable blocks of concrete might be left in the floor. In an emergency during the dry season such blocks could be removed and occupants could attempt to dig a crude well.

8. Sleeping accommodations may be feasible with Navy-type hammocks and suitable anchors fixed in the walls.

9. Artificial illumination of the interior may be needed. This could be built in or portable.

Toward More Large Culverts for Civil Defense

This is a problem of maximizing public benefits with multiple uses and (currently) minimizing incremental costs assignable to civil defense. We have not worked this out. Contributions toward that end appear in Appendix B. Table 4 is taken therefrom. From Table 4 it is apparent that 8'x 8' culverts are less expensive than the others. The triple 8'x 8' is the cheapest in all but the last two cases. If the banks of the streambed must be protected anyway (so their lining cost can be subtracted) and if the value of the land over the

culvert (or the equivalent alongside) can be realized, then the single 8'x 8' culvert is the best buy for shelter. This is because the additional land needed for the next size is not large compared to the area needed to put the smallest culvert in.

Observe in the last line of Table 4 that the actual cost of culverts/shelters may drop as low as $14 per person under favorable conditions, and this for a PF over 1000, blast resistance of about 5 psi and good protection from flashburns and mass fires--and even these sterling qualities can be improved rather readily, as we have seen. The entries of Table 4 should remind Civil Defense authorities of the importance of careful incremental costing. New covered drainage facilities may be one way to add passive protection at low cost, if advantage is taken of construction that must be done anyway.

Note that we have ignored in these cost estimates the possibility of additional taxes coming from the land made available by these integrated procedures. If this were to be included (in those cases where it is applicable) the cost per person of shelter in culverts would drop still lower.

Table 4

PER PERSON COSTS OF SHELTER IN STANDARD CULVERTS

Culvert Dimensions	15'x 13.5'	10'x 10'	Single 8'x 8'	Double 8'x 8'	Triple 8'x 8'
Cost of Culvert	$120	$104	$88	$74	$67
Culvert Minus Land @ $.10/sq ft (as for parks)	116	99	83	71	65
Culvert Minus Land @ $.50/sq ft (as for subdevelopment)	99	81	64	60	56
Culvert Minus Open Channel	68	54	38	39	38
Culvert Minus O.C. Minus Land @ .10	64	49	33	36	36
Culvert Minus O.C. Minus Land @ .50	47	31	14	25	27

Notes: 1) All costs are $ per shelter space at 10 sq ft per person, assuming adequate ventilation.

2) Land is that saved by not using open channel.

3) The 15' x 13.5' culvert is the existing one under the San Tomas Expressway. All others are California State standard.

4) Columns do not add due to rounding off.

OPEN DRAINAGE FACILITIES--WITH STANDING WATER ADDED FOR SHIELDING

Having found promising passive protection in covered drainage facilities, we are tempted to continue the search for untapped protection possibilities along these same lines and take a look at open drainage facilities. San Jose uses not only buried culverts to carry away its runoff rainwater, it also uses open improved channels, as detailed on the facing map.

The open channels shown are all greater than 6' in depth, so that people standing, sitting or lying within will have their head and body below grade. This was done to limit their gamma-ray exposure to skyshine and whatever comes from fallout within the channel itself. The belowgrade position eliminates the direct contribution from fallout on the ground outside the channel.

Two kinds of lined channels are distinguished on the map, those having vertical sides and those having sloping sides. However these differences are only significant for protection from fallout gamma-radiation. Here where we are looking for direct-effects protection the nature of the channel bank makes no difference. Numbers and letters alongside the open channels shown on the map are for identification. They refer to the table of channel characteristics given in Appendix B. These need not concern us here.

The best and most general protection to be found in open channels from the direct effects of flashburn, blast, mass fire and fallout is obtained by submerging the body in appreciable water--with the head out as required. Admittedly this is a pretty crude procedure for protection, and certain aspects have yet to be proved in practice; but it seems likely to be much better than nothing. Where nothing else is available, protection from direct effects may be sought by surrounding the body with as much water as possible.

A body clothed and immersed in appreciable water has fair protection from flashburn, mass fire and fallout, and some protection from blast. If the head is out it needs to be covered with opaque and incombustible material (against flashburn, mass fire and fallout deposits)--perhaps a wet towel will do (and the towel should be cleaned of loose fallout particles from time to time).

A general exploration of the protection from nuclear weapons effects that is possible in principle with standing water is given in Appendix C.

The Need for Standing Water in Open Drainage Channels

We have already noted that the drainage channels in San Jose contain but little water most of the time. Thus as they stand they are not suitable for passive protection from direct effects and radioactive fallout. For such protection requires near-total immersion, requires standing water a few feet deep. To make the open drainage channels useful for protecting the people of San Jose the standing water must be raised to a depth of at least 18 inches. It is presumed that this could be done with simple small cross-channel dams at intervals along the lengths of the channels. Some additional feedwater may also be required from upstream reservoirs to maintain these channel water depths during the dry season.

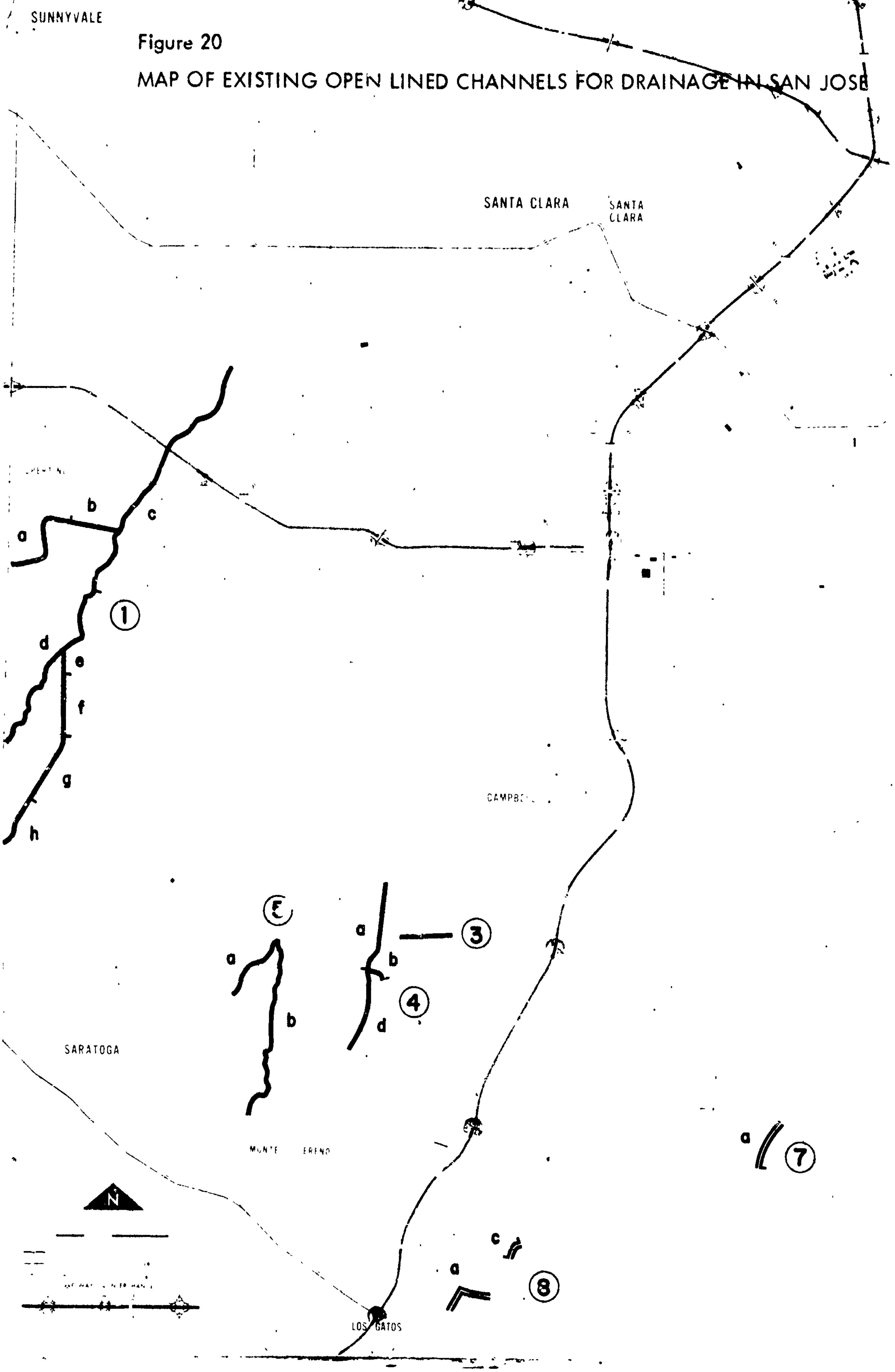
The Hazards of Prolonged Immersion

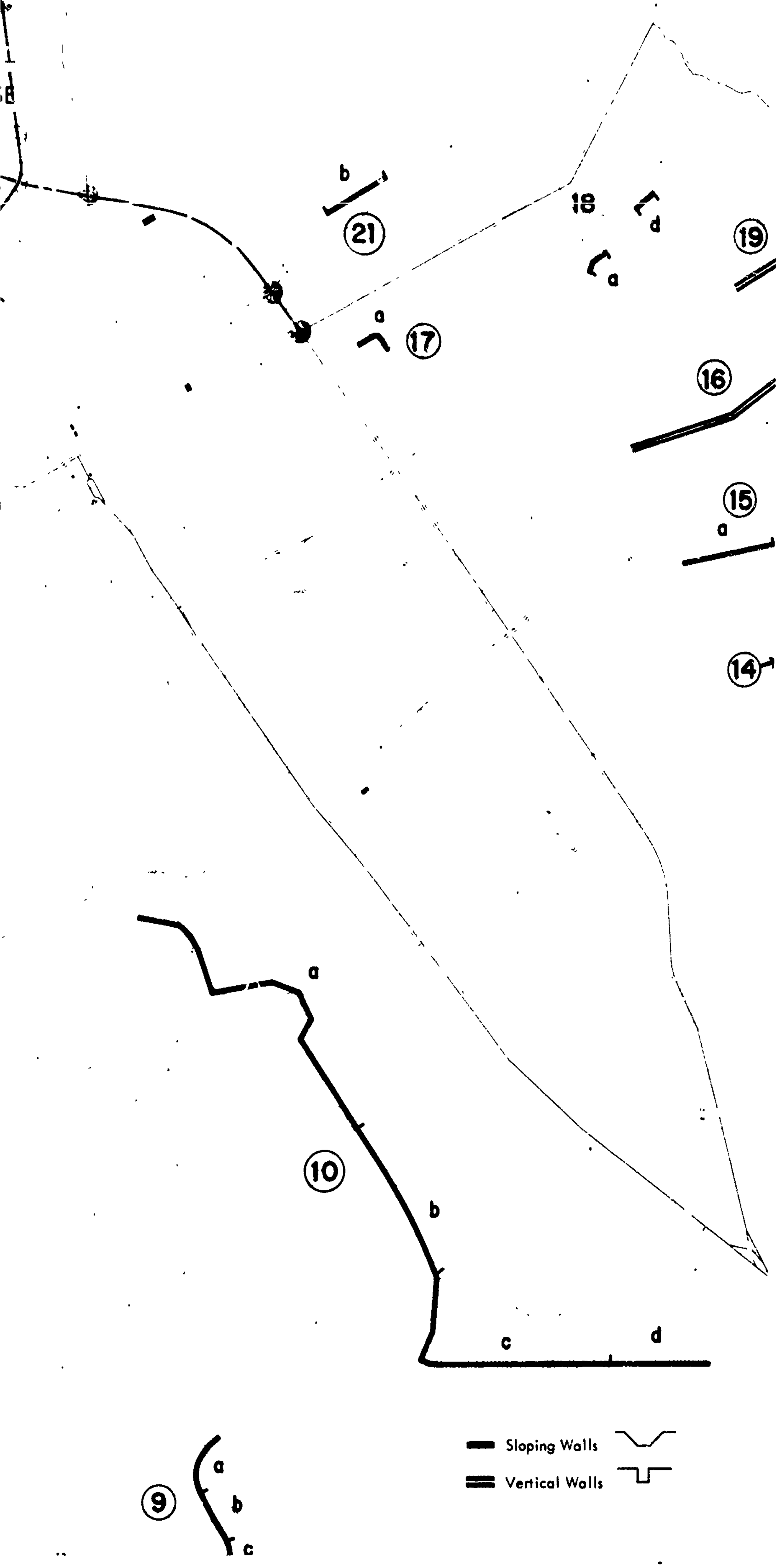
It is well known that many people, threatened by mass fire in Hamburg and Hiroshima, attempted to escape by getting into nearby canals and rivers. And some successfully evaded the fire effects in this way. However the duration of the immersion necessary in those cases was a matter of hours; here, for protection against nuclear weapons effects we may be concerned with immersion for days.

Prolonged immersion brings on serious problems of its own. These include maintaining deep body temperature in spite of the cold water surroundings, preventing excessive loss of body fluids from the body's reaction to cold and water pressure, and avoiding permanent degradation of the skin from continued water contact. No claim is made here that these problems are solved or illusory. Rather does it appear that water immersion has a potential for protection if the attendant difficulties from the immersion itself can be overcome. Research and development to realize a practical procedure for protecting people by immersion in water are believed to be essential to further progress in this direction.

Figure 20

MAP OF EXISTING OPEN LINED CHANNELS FOR DRAINAGE IN SAN JOSE




21
b
18
d
a
19
17
a
16
15
a
14
10
a
b
c
d
9
a
b
c
Sloping Walls
Vertical Walls

PRINCIPAL CREEKS AND RIVERS--STANDING WATER ADDED FOR SHIELDING

Since direct-effects protection in open channels is independent of the nature of the banks--requiring immersion in any case--we can bring in all the natural drainage channels too, in our search for expedient shielding for the people of San Jose. The principal creeks and rivers are shown on the facing map.

Following exactly the procedures just described for open drainage facilities, if the standing water in the creeks and rivers is not enough for whole-body immersion (with the head out), the water level will have to be raised (to at least 18" total depth). Again this seems feasible with occasional small cross-channel dams.

This consideration of natural stream beds for direct-effects protection introduces a new hazard not present with lined channels. This is the possibility of fires developing postattack, right down in the watercourses themselves due to the burning of the trees and ground cover present. As shown in Appendix D, where the characteristics of the principal streams are documented, some parts of these natural channels appear very susceptible to fire (heavily overgrown) while other parts look safer for lack of sizable combustibles. Where these natural channels must be used for protection, consideration should be given to reducing the weight of fuel they contain by removing unnecessary trees and shrubs.

It is to be noted that there is considerable interest in San Jose in the development of their natural streams into continuous parks or chains of parks. Any such move should be advantageous for civil defense--by improving streambed conditions and making access better. And conversely, the civil defense requirement for 18" or more of standing water (for emergency shielding by immersion) should be advantageous for park and recreational purposes. With appreciable standing water, fishing and boating become feasible and the general appearance is enhanced. Thus the development of the natural creeks and rivers of San Jose for parks and passive protection appears to be mutually supporting.

A rough measurement shows that the entire population of San Jose could be put into its principal creeks and rivers if they were all to be used. Thus (given enough advance warning) we can at least provide everyone this much protection, if satisfactory procedures for emergency shielding in standing water can be evolved.

NEARBY LAKES, BAY AND OCEAN FOR EMERGENCY SHIELDING

If water immersion can be made protective against direct effects, we may wish to note the presence of these large bodies of water--already of appreciable depth. Immersion of the body in the Santa Clara County lakes would be similar to the use of the open drainage facilities for protection. Because of their expanse they may be somewhat less subject to mass fire difficulties, but because of their openness their occupants may be somewhat more exposed to flashburns, blast and fallout. In general the lakes are more remote from the people to be protected than the creeks and rivers.

The San Francisco Bay offers water all right, but it is hard to get into from San Jose because of the extensive bounding mud flats. And once there, one would find nothing else: no stores, no houses, nothing that one did not take along with him. The water of the Bay is unfit for drinking, and hard on the skin; and tidal movements of its level would require changes in position. Perhaps most important, the Bay appears to be in the direction of increasing threat, since all the recognized possible targets of enemy attack are in that direction. Moving into the Bay is not generally attractive.

The Pacific Ocean is near San Jose, but far enough away to be more properly considered under evacuation, not area-wide shelter systems. Additionally the temperature, surf, tidal movements and saline water all seem disadvantageous for immersion.

No detailed consideration of the use of any of these possibilities--lakes, Bay or Ocean--has been attempted by this study.

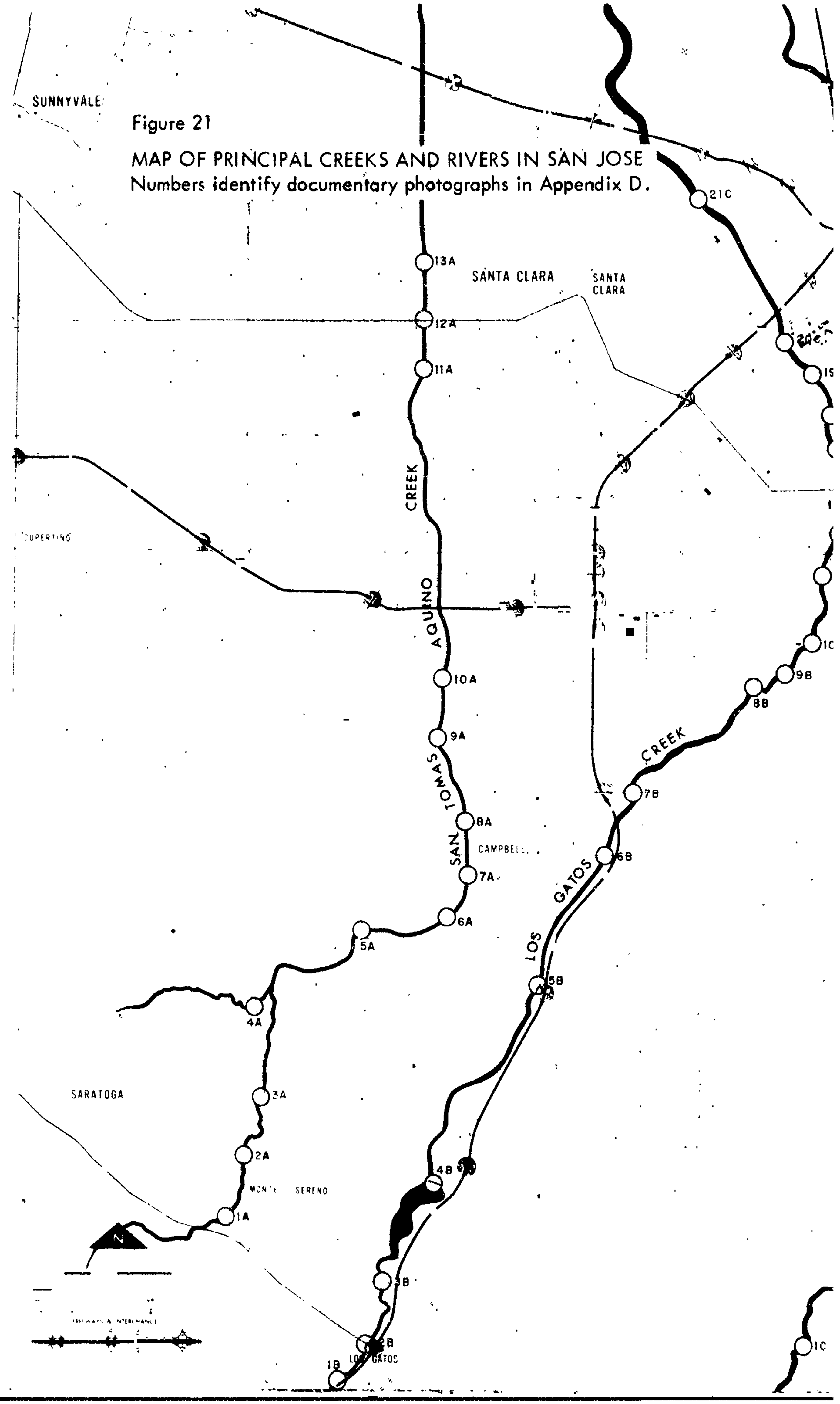
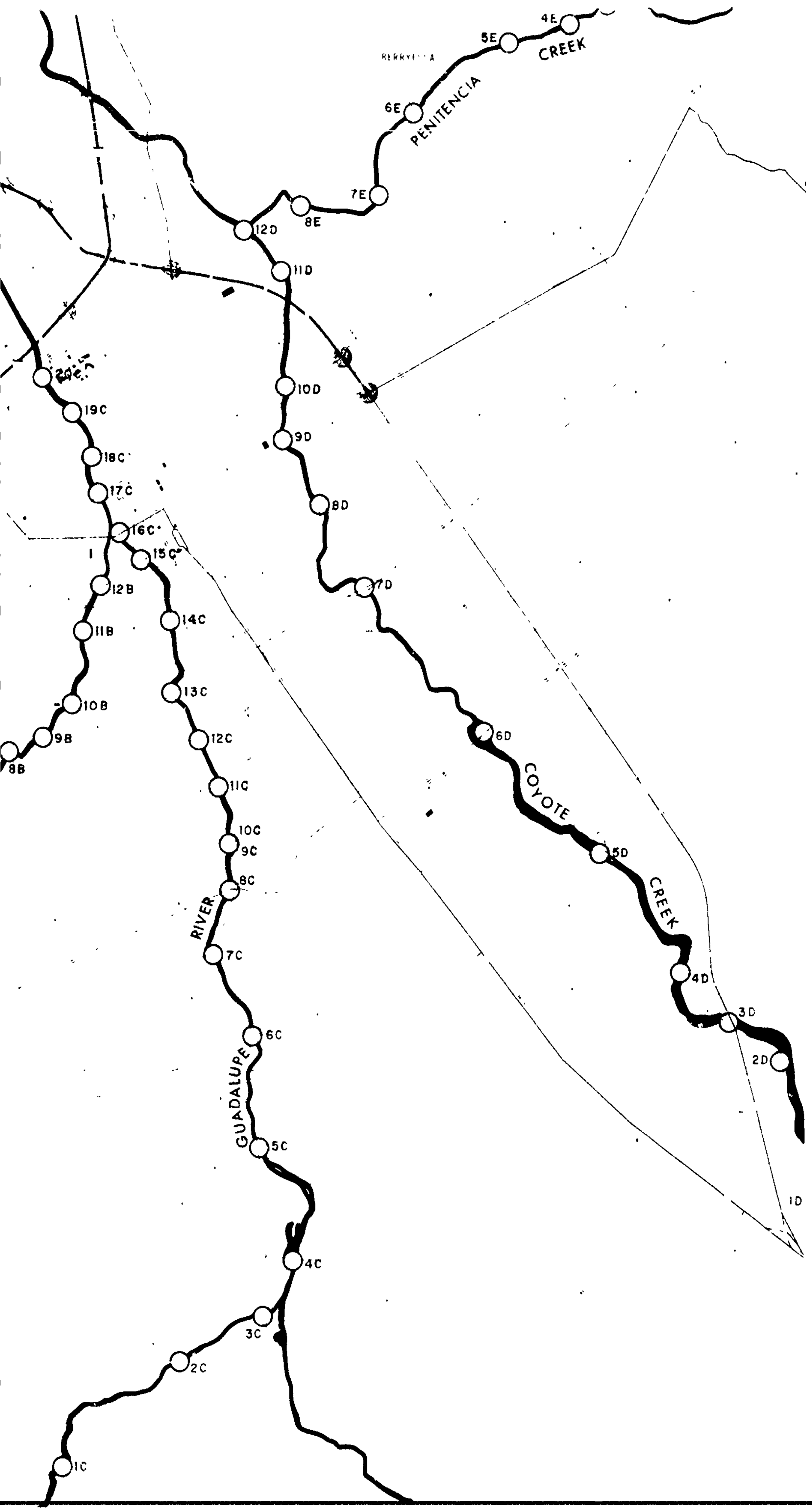


Figure 21

MAP OF PRINCIPAL CREEKS AND RIVERS IN SAN JOSE
Numbers identify documentary photographs in Appendix D.



PENITENCIA
CREEK
4E
5E
6E
7E
8E
12D
11D
10D
9D
8D
7D
6D
COYOTE
CREEK
5D
4D
3D
2D
1D
20C
19C
18C
17C
16C
15C
14C
13C
12C
11C
10C
9C
8C
RIVER
7C
6C
GUADALUPE
5C
4C
3C
2C
1C
12B
11B
10B
9B
8B

LARGE INCOMBUSTIBLE OPEN AREAS WITHIN THE COMMUNITY

The large incombustible open areas within the built-up parts of American communities have an indispensable role to play in providing protection for Direct-Effects Regions. They are oases or refuges from the effects of mass fire. People in their central regions can escape the overpowering heat and can find air fit to breathe. And they remain relatively free from the residual effects of blast (and fire): the debris from the disintegration of buildings and structures. Risks of being trapped in shelter or being blocked from entering shelter are minimized if the shelter is located within the central regions of large incombustible open areas.

Unsheltered survivors of direct effects will be forced to these large open areas by the widespread postattack community fire, and when they get there the chances are good that they can get into any shelters which have been built there and not seriously overstressed by the attack. Access to similar shelters constructed elsewhere in the community is less likely because of blast products, and the heat from the general fire.

We visualize a progressively increasing use of the large open areas within the community for civil defense, as follows:

1. Used as refuge from fire. (Refugees vulnerable to fallout, or the direct effects from later nearby explosions.)

2. Provided with expedient protection in the form of hastily prepared narrow trenches. (Only protective for relatively short periods of time due to the instability of the soil.)

3. Provided with permanent protection by constructing new blast or limited-blast shelters at these preferred locations.

4. Prepared to be the base for postattack recovery as the requirement to remain in shelter fades away.

The principal large incombustible open areas, of interest for civil defense in San Jose are the public school grounds and parks.

Public School Grounds

We show on the facing page the locations of public school grounds in San Jose evaluated as desirable for use and development for passive protection.

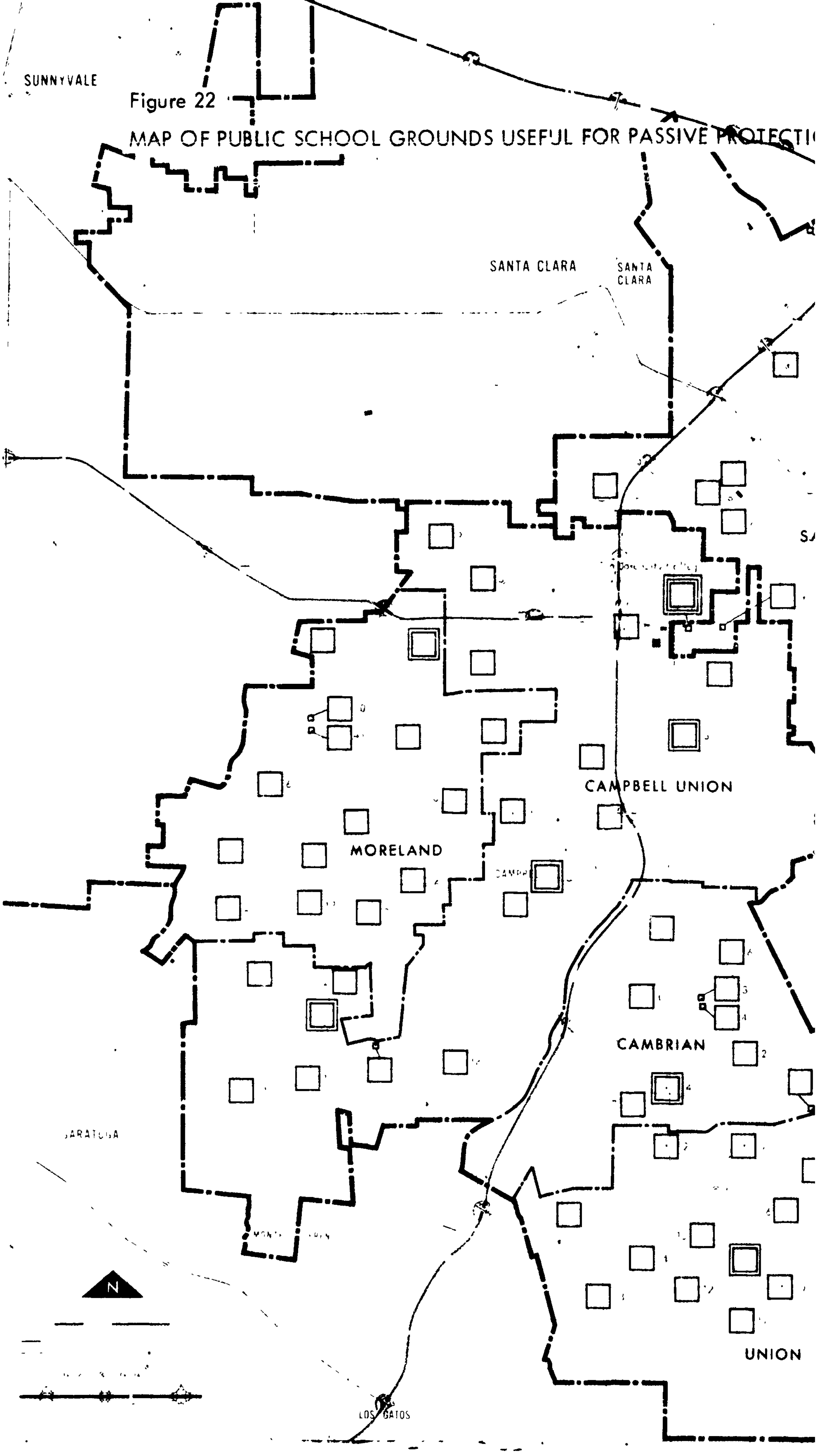
The spaces nominated for consideration had to provide (1) a barrier strip (for relief from fire effects) 50 yards wide, opposite single-story, detached, one-family residences; 100 yards wide, opposite multiple story or row houses or other buildings (based on experience with the great Hamburg fire of World War II). And (2) after the fire barrier was provided for, there still had to be sufficient interior area to accommodate large numbers of people or shelter spaces. All this for regions remote from any firestorm area.

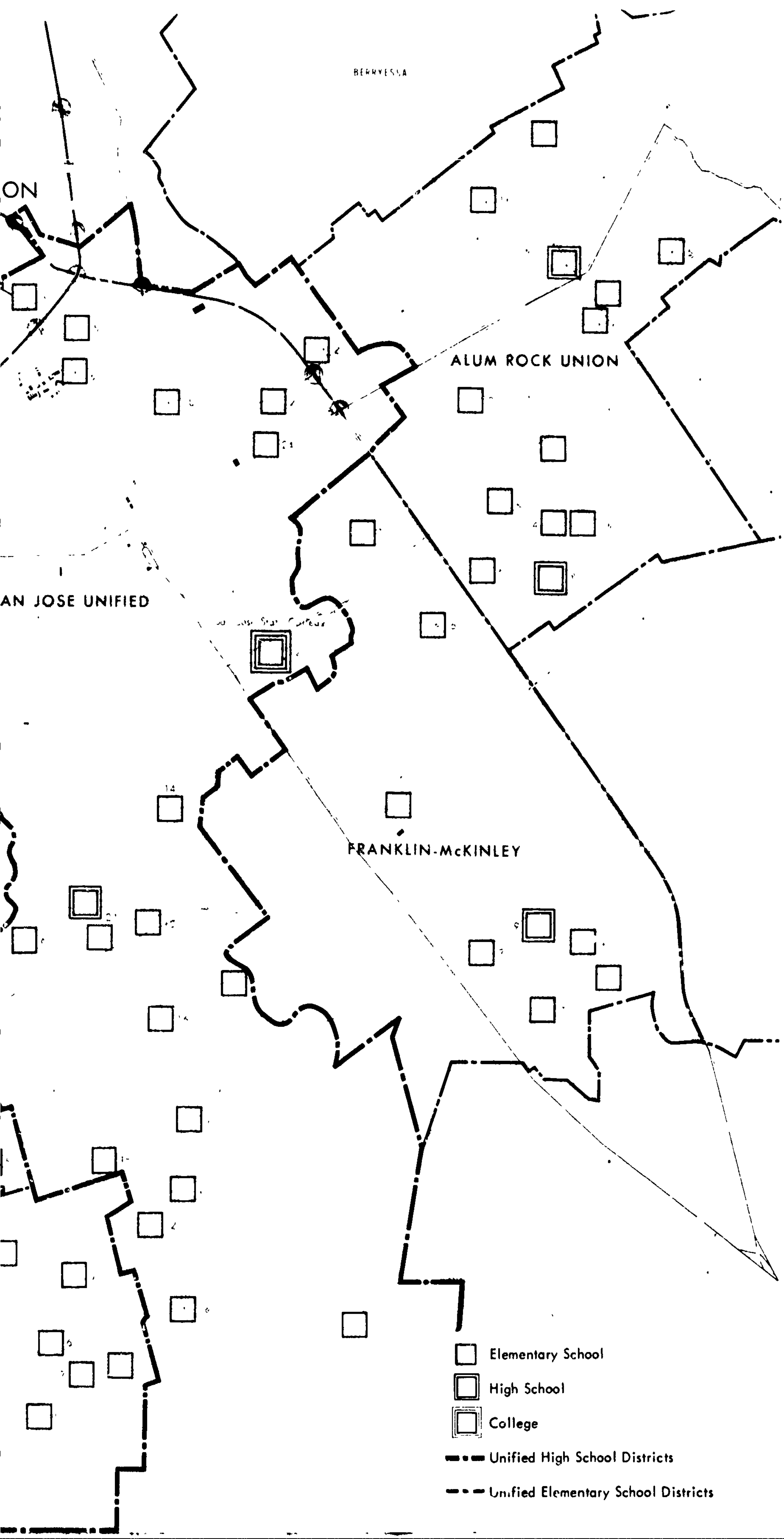
For open areas in or adjoining potential fire storm areas, the barrier strip was set at 1/4 mile (as a first estimate).

Because of the importance of these public school grounds for the future of civil defense in San Jose, there is given in Appendix E a summary table of their individual characteristics. In addition some sample plot plans are shown with the area currently available for passive protection indicated, using the rules just described.

Figure 22

MAP OF PUBLIC SCHOOL GROUNDS USEFUL FOR PASSIVE PROTECTI




BERRYESSA
ALUM ROCK UNION
ON
AN JOSE UNIFIED
FRANKLIN-McKINLEY
14
Elementary School
High School
College
Unified High School Districts
Unified Elementary School Districts

Public Parks

On the facing page there is given a map of public parks within the community of San Jose judged valuable for civil defense.

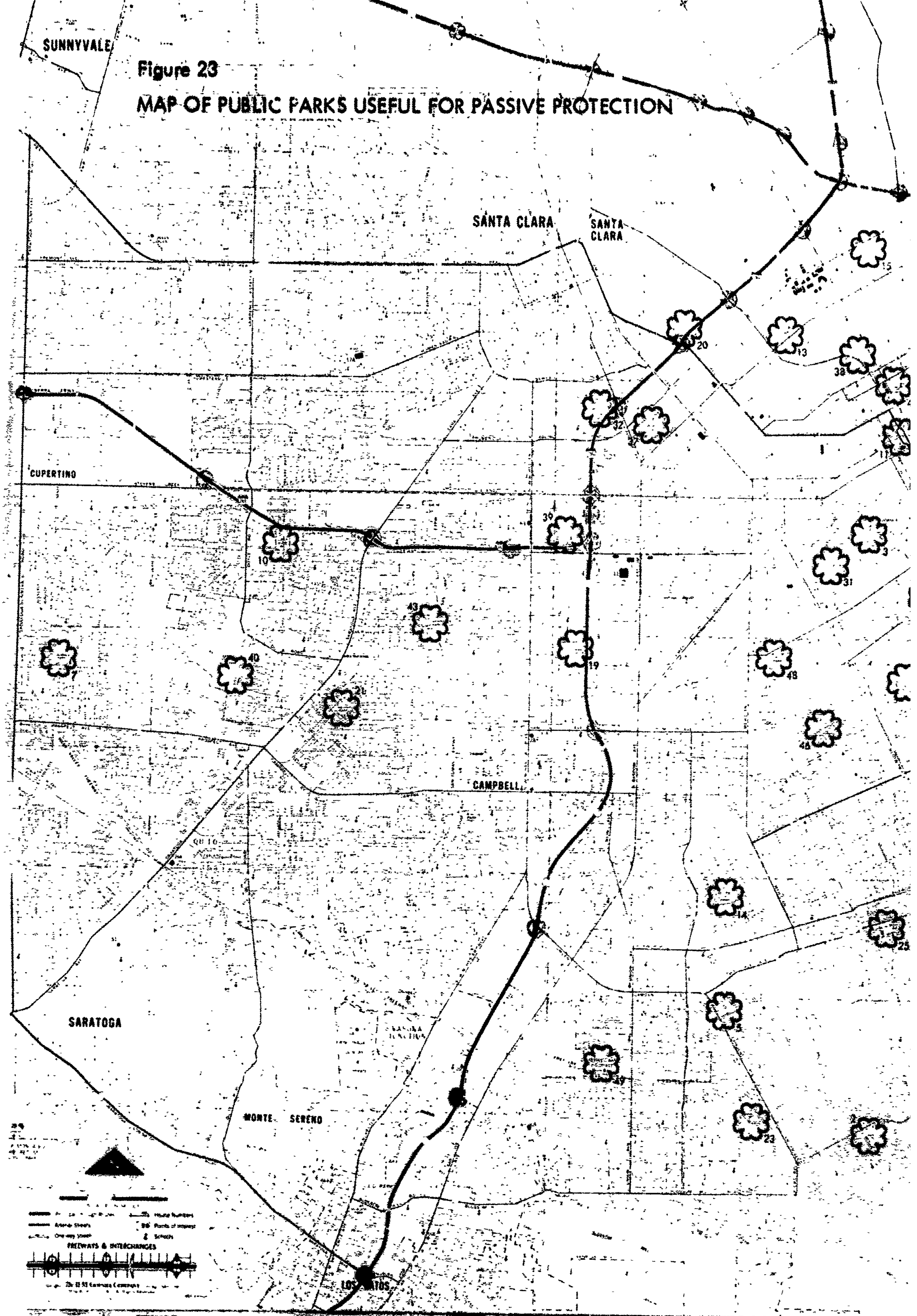
Plot plans of these parks are given in Appendix F to show their useful interior areas, using the same rough criteria previously applied to the school grounds.

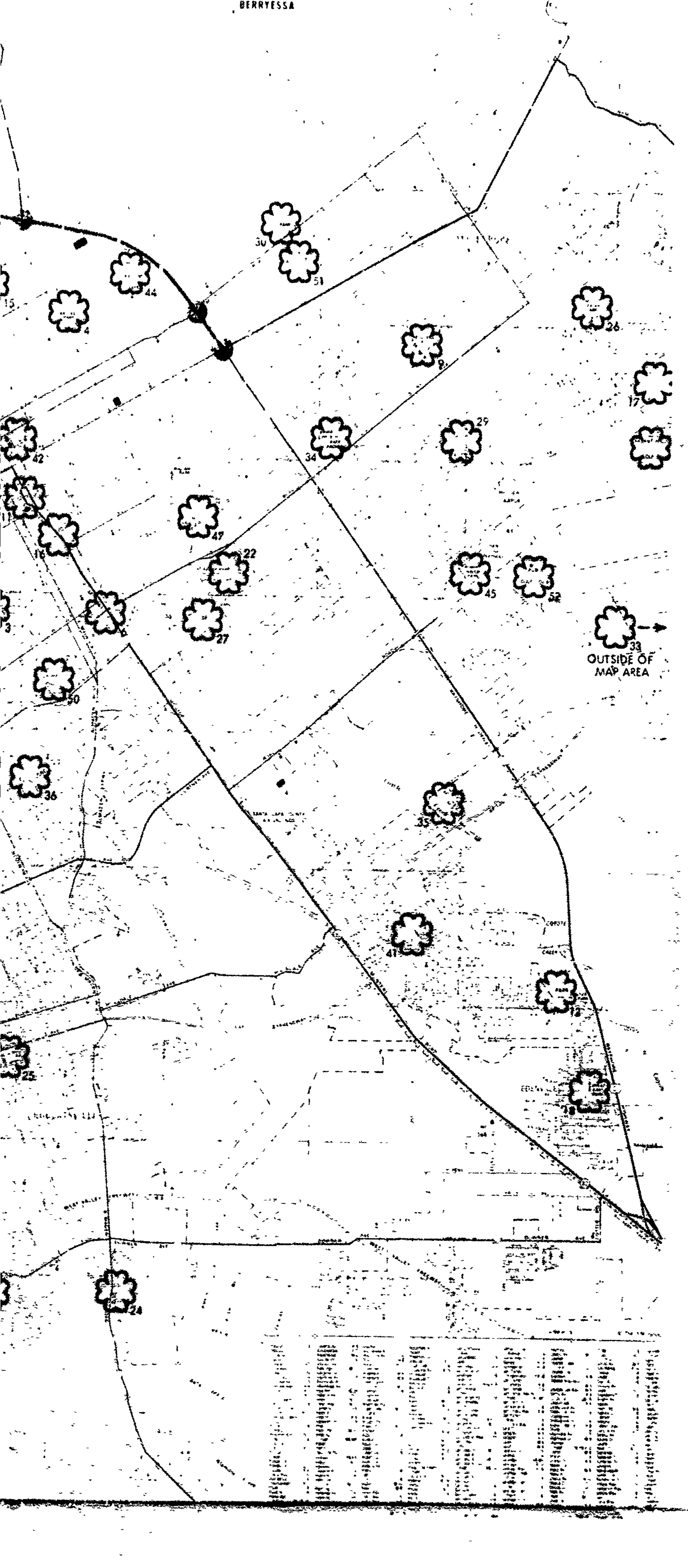
* * * * *

Except for the downtown region of San Jose, there appear to be ample public school grounds and parks suitably distributed throughout the City to which people can go to escape the effects of a general community fire. The situation downtown requires a closer look, and that will be postponed until the next chapter.

Figure 23

MAP OF PUBLIC PARKS USEFUL FOR PASSIVE PROTECTION




BERRYESSA
OUTSIDE OF MAP AREA
30
51
44
15
4
26
9
17
29
42
34
47
22
45
52
33
27
50
36
35
41
12
18
25
24

FUTURE NEW SHELTER/SHIELDING FOR LARGE OPEN AREAS

The large incombustible open areas in San Jose (chiefly public school grounds and parks) are already of great value as places to escape a mass fire of the community. Used as a second stage of protection after people are driven out of their fire-vulnerable first-stage NFSS Basement Shelters, they allow many people to live who would otherwise die in their absence. Such two-stage dynamic protection promotes survivors from the hypothetical first attack of the Five-City Study: an airburst over Moffett Field. But such survival is contingent on nothing else happening--nothing!--either before or after that postulated airburst. If deadly fallout were already outside when the Moffett Field airburst occurred, the postattack fire could drive some people out of their NFSS shelters into the fallout and to their doom. And if another weapon exploded in the vicinity after the Moffett Field airburst it would find the people who escaped to the open areas as vulnerable as could be. For they would be in the open and totally exposed, totally exposed to flashburn, to blast and to fallout. (Their only protection is from mass fire.) Clearly, the people who make it to open areas need some kind of protection from subsequent weapons effects. Now we will consider what this future new shelter/shielding might be.

Digging Man-Sized Trenches in Large Open Areas for Increased Emergency-Readiness

The simplest worthwhile protection we can think of to add to large incombustible open areas is that of man-sized trenches. These can be dug rapidly, they offer fair protection, and they are cheap. As shown in Appendix C, such trenches must be kept narrow to provide a significant Protection Factor against fallout gamma-radiation, without cover or decontamination. The narrowness will also improve blast protection, and reduce cost. (It tends to increase discomfort.) We would prefer trenches about 2 feet wide, but human dimensions suggest a 2-1/2 foot width would improve living conditions appreciably. A six foot depth seems suitable. Some of the salient features of these trenches are given in the first line of Table 5.

The cost and time figures in Table 5 are very rough approximations, intended only for broad comparisons. Note that the simple trench can be provided in quantity in very short times (assuming all plans and preparations were made ahead of time), but the nature of the soil in San Jose is such that those trenches will not remain as dug. Their vertical earth walls will slip away and cave-ins will result. One probably should not count on using them for more than 2-4 weeks after digging.

Note carefully, if trenches are built in large open areas to take care of people driven out of fire-vulnerable shelters, those people may be better protected if they go directly to the trenches in the first place! For then they would not have to risk being driven out into early deadly fallout by later mass fire. They would have Universal Protection in their trench--although it might not be very high grade. For Direct-Effects Regions, narrow man-sized trenches in large open areas are probably better protection than NFSS Basement Shelters "as is"--where the latter are vulnerable to mass fire. If the NFSS Basement Shelters can be successfully upgraded to 5 psi, then they may approach the protection of trenches in open areas. But note that such upgrading requires a practical procedure for providing breathable air to the shelterees in a basement vented by blast and exposed to mass fire effects--a procedure presently unknown. No such problem arises in narrow trenches because of their favorable location a sufficient distance away from the nearest possible front of the mass fire. We know how to make trenches, and people therein are not seriously threatened with heat or foul air from the burning community as long as the trenches are in the interior portions of large incombustible open areas.

To extend the life of these raw earth trenches, the walls can be shored as necessary with simple wooden struts spanning from wall to wall. This could be done as the digging was completed; or it could be done sometime later (but before the walls start to fail). Shoring tends to add appreciably to the cost, as shown in Table 5, but the service life of the trench gets a real boost.

Table 5

SCHEDULE OF SHELTER/SHIELDING POSSIBILITIES FOR OPEN AREAS

Shelter/Shielding	Time to Construct	Rough Cost Per Person	Useful Life	Competitive Alternatives for the Community
Simple Open Trench (spoil left)	several days	$ .50 - $1.00	1/2 - 1 month	Raising water level in creeks and rivers (if protection by immersion proves to be practical)
Trench Walls Shored with Wood (for longer life)	several days	$2.50 - $5.00	3 - 6 months	
Shored Trench Covered with Planks and Earth (to improve protection)	several days	$12 - $15	3 - 6 months	
Wider Trench with Culverts Added and Covered with Earth (no furnishings)	several weeks	$50 - $100	20 years	Upgrade NFSS Basement Shelters
New Semi-Permanent Limited-Blast Shelters (with furnishings)	several weeks	$50 - $80	5 years	
New Permanent Limited-Blast Shelters (with furnishings)	several months	$125	20 years	None
New Permanent Blast Shelters (with furnishings)	several months	$200	20 years	

To increase the protection the trench could be covered in various ways. We consider only one such procedure: wooden pl nks spanning the trench at the surface and piled over with dirt taken out of the trench. A plastic membrane may be included in the cover to help keep the cover and the trench below dry and intact. Massive covers make the protection from flash excellent, and they improve protection from blast and fallout appreciably. The protection from mass fires was already good, but the cover makes it better. Living conditions within the trench will also be improved by a stout cover. The covers run the cost up as suggested by Table 5. The useful life is probably not affected very much since it depends on the walls, which may now be dryer and perhaps somewhat stronger, but must now carry a heavier load because of the cover. The cover also makes the land (school ground or park) less hazardous than when it contains a lot of open trenches. With adequate preplanning and prior arrangements these simple covers could be installed in concert with the initial digging and shoring operations--thus very little additional time need be involved. (Or, at the other extreme, trench covers could be added at some later time in a few days as a separate construction project.)

* * * * *

Make no mistake, living in crude little slots carved out of the ground, with rain and cold, caved-in walls, and muck and filth will not be comfortable, and it may be miserable. But the protection from the direct-effects of nuclear attack will be far better than staying home in bed, or crouching in a basement vulnerable to fire. One may not live well, but one may live! However, the living conditions of this kind of protection are so poor, and the chance of such protection not being ready in time is so real, that the people involved may well wish to consider whether this is the approach they want to follow.

* * * * *

<u>The logic of trenching open areas</u> seems to be:

1. <u>No actual trenching</u> should be done until there is <u>a real threat</u> of nuclear attack. This is because the useful life of simple earth ditches is not long. Plans for protective trenches and prearrangements for their prompt construction where needed should definitely be made in advance (i.e. now), so that community reaction to the threat of attack can be as rapid as possible.

2. Since the trenching will be done in anticipation of (or to guard against) actual attack, the <u>best possible protection</u> should be sought. Time is presumably of the essence (not money) and no procedure is known other than trenching which can so rapidly bring a good level of protection to the large open areas within the community. Since shoring the walls and covering the top of the trenches improve the protection significantly and extend their useful life, <u>shoring and covering should accompany the digging</u>. (The only disadvantage of these additional steps is their expense. Simple trenches for 300,000 people (San Jose) may cost $250,000; while covered and shored, the cost may be $4,000,000. It is presumed that the City of San Jose could more readily execute an emergency project costing $250,000 than one costing $4,000,000. As the amounts of these potential life-or-death expenditures rise, one may encounter an unwillingness on the part of responsible officials to proceed, or an inability on the part of the city to pay (or borrow). This may be a pertinent area for OCD research: To determine current administrative/financial roadblocks to local governments' ability to provide expedient protection when the threat of nuclear attack appears real; and the local and Federal actions which would ameliorate those difficulties.)

If attack appears imminent this is the only community approach to follow (for those still unsheltered). So if another approach is to be taken it must be adopted when attack does not appear imminent. As outlined in Table 5, the peacetime options include: (A) Doing nothing (but planning) now and constructing temporary, one-shot trenches later when attack threatens; or (B) Building more permanent protection now with a useful life sufficient to make it available when attack threatens at some later time. To encourage the adoption of this latter view it can be noted that even though trenches can probably be constructed (under ideal conditions) in a matter of days, it cannot be guaranteed that there will be that much advance notice of enemy attack. Clearly if we want assured protection we should build it now, before attack appears likely. If the latter view is adopted, there are additional options between (a) useful life, (b) living conditions, and (c) degree of protection.

As shown in Table 5, one could: (1) Put in culverts for permanent ditch-type shelter. Or for about the same money: (2) Build semi-permanent shelters of wood with furnishings and vastly improved living conditions, and similar (or slightly less) protection. Or for more money: (3) Construct permanent good-living shelters with appreciably better protection against direct effects and radioactive fallout.

Whatever is done in advance of nuclear threat currently appears expensive and that investment should therefore probably be permanent (to protect against an unknown future threat) and adequately protective. If we limit our consideration just to permanent construction, then we are left with two classes of habitability: (a) culvert-type shielding and (b) dormitory-type shelter; and two classes of protection: (a) limited-blast (for Fallout-Only Regions) and (b) blast (for Direct Effects Regions).

The only recognized reason to pick culvert-type shielding is for economy: It may be one-half or one-third the cost of dormitory-type shelter.

<u>The logic of building shelter in open areas</u> seems to be:

1. The strictly economy minded (who care not about living conditions) should go for culvert-type permanent shielding.

2. Those putting a higher premium on living conditions (but still trying to keep costs down) should go for dormitory-type permanent shelter with

   a. Limited blast resistance (for Fallout-Only Regions), or

   b. Full blast resistance (for Direct-Effects Regions).

3. The dormitory-type shelters have definite advantages over the culvert-type shielding for other uses in peacetime, and as bases for recovery operations in the postattack period. Thus they tend to be more useful before, during and after nuclear attack.

* * * * *

In a previous part of this chapter we have already remarked on culverts as protective facilities; and more detail appears in Appendix B. The dormitory-type shelters mentioned above will be described further on the pages that follow.

Constructing Limited-Blast Shelters in Large Open Areas

Our purpose here is not to present the best design, the latest thinking or the most economical form of limited blast shelter, but rather to give some notion of this general type of protective structure as it might be installed in the large incombustible open areas of San Jose.

A 1962 review of existing published preliminary designs* showed the following under the category "Underground Shelter as a Separate Building":

City of Livermore Shelter
County of Los Angeles Shelter
OCDM Shelter & Parking Garage (Amman & Whitney)
OCD Shelter & Parking Garage--G35-1
USNRDL-Type Shelter
Foreign Shelters

The first four of these are roughly similar, being rectangular reinforced-concrete structures with interior columns and roofs at or near normal grade. The fifth is a multiplate corrugated steel-arch structure (see following pages).

Since that time OCD publications for this kind of shelter have included:

"Parking Garage and Community Shelter for 5000 Persons with Blast Resistance Capacity of 5, 25 & 50 psi"	G35-2	April 1963
"Dual Purpose Suburban Community Shelter for 100, 500 & 1,000 Persons and a Blast Capacity of 5, 25 & 50 psi"	C45-2	June 1963
"Community Fallout Shelter 500 Persons Capacity Steel Arch Type"	C45-3	March 1964

* Richard I. Condit, National Opportunities for Furthering Civil Defense through Urban Renewal and Other New Construction, Stanford Research Institute for the Urban Renewal Administration, November 1962.

The first two of these are column-supported rectangular reinforced-concrete; and the last is multiplate steel. Thus a variety of approaches exist which relate to our needs.

As a specific example, we show on the facing page a display of the proposed design for the City of Livermore Shelters.* These shelters are rectangular reinforced-concrete with interior columns, intended to be installed under the playgrounds of selected public schools in Livermore, California--an installation like the one proposed here for San Jose.

Skipping over many interesting features of this design, we note only that it provides indoor dormitory-type accommodations: bunks and tables, food and water, sanitary facilities, medical supplies, forced-air ventilation, electric lights, blast doors, and arrangements for personal decontamination upon entry (if necessary). While this design proposal seems realistically austere, its living conditions are obviously a far cry from a simple ditch, or even a crudely covered ditch, or the bare concrete culverts also considered here for installation in large open areas.

* * * * *

The city officials of Livermore concluded (1962):

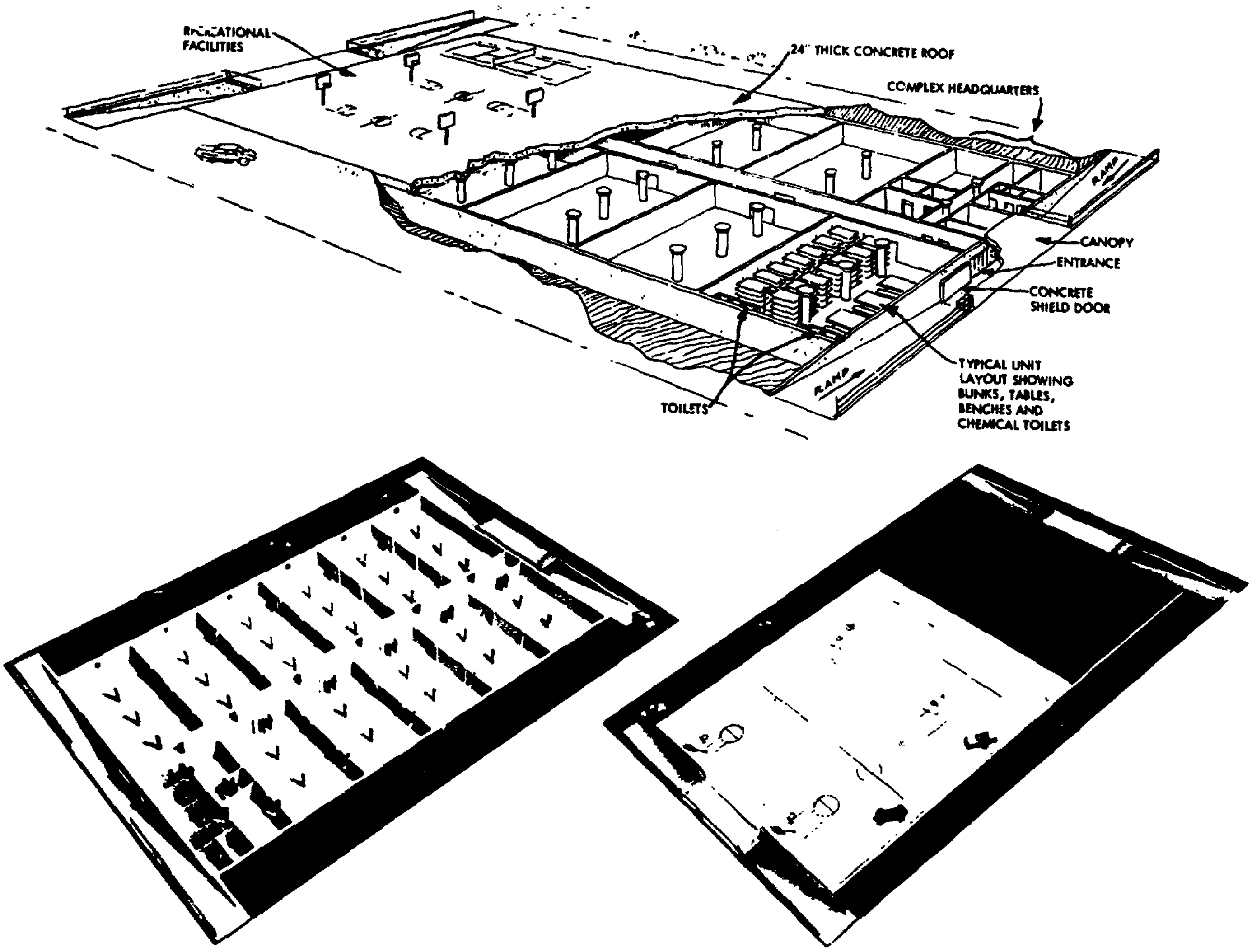
". . . protection from the dangers of radioactive fallout hazards can be provided for our entire community. This can be accomplished in an efficient and economical manner so as to safeguard the citizenry from any disastrous eventuality."

* * * * *

* Community Shelter Report, City of Livermore, California, April 1962.

Figure 24

COMMUNITY SHELTER PROPOSED BY THE CITY OF LIVERMORE



Constructing Blast Shelters in Large Open Areas

The principal difference between these shelters and the ones on the previous page is in blast resistance. The category of the previous page is intended to withstand 5-10 psi peak overpressure (limited-blast shelter); those to be considered now should survive 25-50 psi peak overpressure (blast shelter). Otherwise they are similar in providing: complete protection from flashburn, mass fire, and Protection Factors of 500-1000 or greater. Both provide dormitory-type accommodations and good living conditions. The principal kinds of construction proposed for both limited-blast and blast snelters are basically the same: (1) rectangular reinforced-concrete, with interior columns, or (2) multiplate steel-arch without columns. Since the former was shown previously as an example of limited-blast shelter, we will show the multiplate steel-arch here. But please note that both styles of construction are adaptable to either blast level.

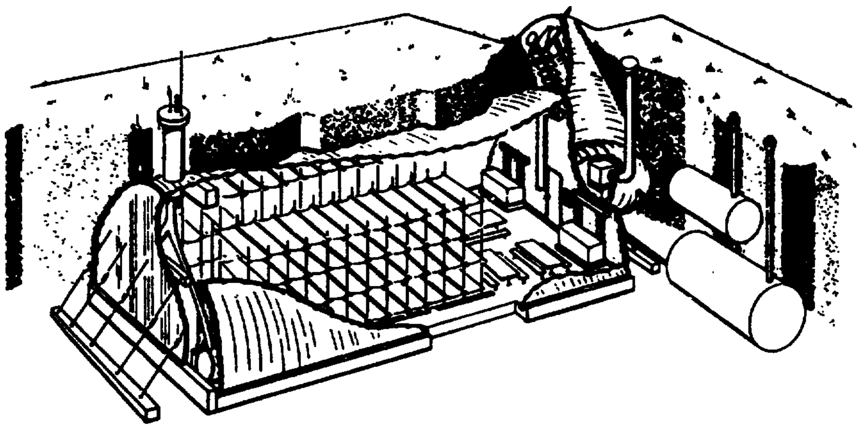
Another reason to show a multiplate steel-arch design here is that this was the shelter indicated in a 1962 study by the City of San Jose of an area-wide shelter program for their community.* The specific shelter chosen was the fifth in the list on the previous page, an NRDL-type shelter. Quoting from their report (p.21):

> "The community shelter is a multi-plate steel-arch structure, 25' wide and 48' long, with three feet of earth above the arch roof for radiation shielding. Adequate foundation, ventilation and entrance facilities are incorporated to provide protection against a 35 psi air blast peak overpressure. Complete sealing of the shelter for 24 hours in the event of mass fire, is provided as are facilities and equipment for providing auxiliary power."

A cutaway view of this shelter is given in Figure 25. The proposed shelter has "a minimum fallout protection factor of 1000."

Figure 25

CUTAWAY VIEW OF NRDL-TYPE SHELTER



* A Community Shelter Program for the City of San Jose, Office of the City Manager, San Jose, California, January 1962.

The San Jose Civil Defense (SJCD) plan was to install these shelters in banks of dual units. Each dual unit would be twice the length of that described above and sketched in Figure 25. The banks of dual units allowed some sharing of common entries. A sample layout along these lines, as visualized by the SJCD, is shown for a typical school site in Figure 26. (All of these features still seem reasonable to this study in 1965. One would want to be sure the shelter entrances were far enough away from the nearest ordinary structures. If the buildings across the street were multistory and/or row houses, and if the intervening street widths were narrow, one might wish to have the exposed shelter entrances pulled back farther into the interior of the school ground. This could be done by putting the entrances at the opposite ends of the shelters or by moving all the shelters inward.)

* * * * *

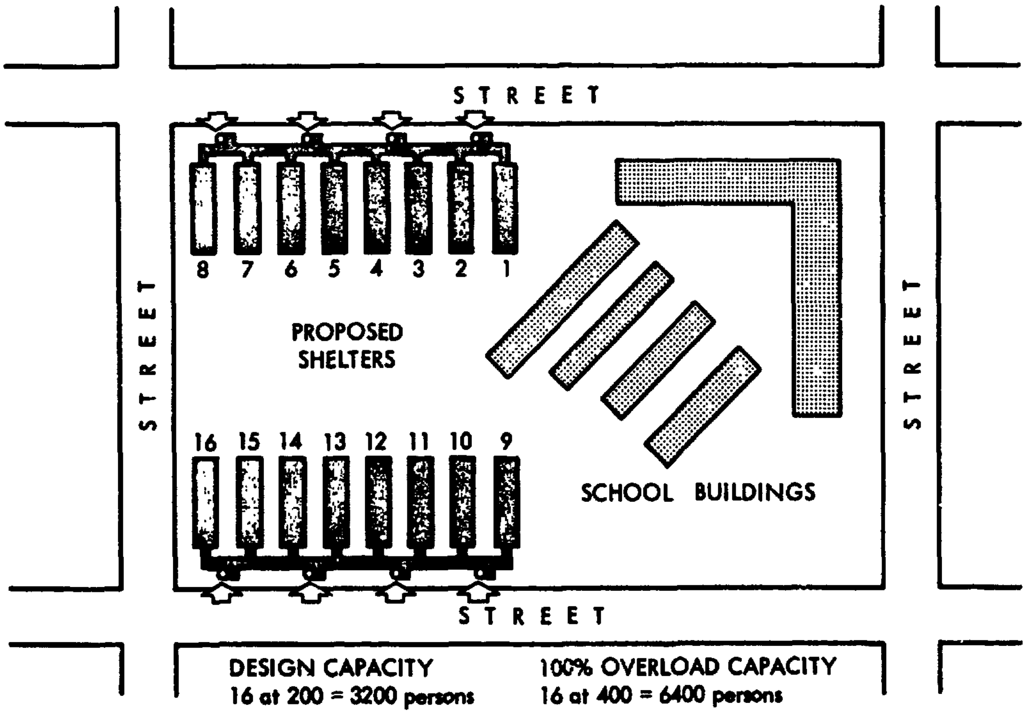
The city officials of San Jose concluded (1962):

". . . It would appear that there is no technical reason why such shelters would not provide a useful level of protection against the effects of nuclear weapons. It would also appear that there is no reason why such a program is not within the means of our community and nation to support."

* * * * *

Figure 26

SAMPLE LAYOUT OF NRDL-TYPE SHELTERS ON TYPICAL SAN JOSE PUBLIC SCHOOL GROUNDS



OTHER POSSIBILITIES FOR PASSIVE PROTECTION IN SAN JOSE (DIRECT EFFECTS)

This section will conclude our treatment of the possibilities for physical protection. We will try to include everything significant that has not yet been mentioned. To help this process we will review briefly the passive protection presented previously in this chapter. Hopefully, this will make the holes that remain more evident.

> We started by considering all the existing large buildings and "special facilities," both publicly owned and privately owned, for shelter suitable for protection from direct effects and fallout. This was the work of the National Fallout Shelter Survey (NFSS). The NFSS results also included estimates of the additional shelter capacity which would result if the existing ventilation in the identified basements were augmented. And then we supplied our own suggestions for upgrading these NFSS Basement Shelters for direct effects protection. This seemingly takes care of the shelter potential in all large buildings and "special facilities." What it does not cover is the smaller buildings: (1) the potential shelters with capacities less than 50 and (2) home basements. So we will give these a look.

Smaller Structures Survey for Shelter

The Smaller Structures Survey (SSS) is intended to be carried out like the National Fallout Shelter Survey and to locate suitable shelter spaces with capacities < 50. To the best of our knowledge no results of this effort are yet available for San Jose. When SSS data appear, these smaller shelters should be added to the inventory of protective resources, and then allocated as appropriate to improve the available protection for the population.

Home Basements as Shelter

According to the 1960 Census, there are some home basements in San Jose, predominantly in the older residential areas. Their distribution by Census Tract is shown in the map of Figure 27. The numbers shown are the number of home basements or (where multiple family dwellings are involved) the number of dwelling units with associated basement space. An apartment house for six families which had a full basement would be listed as a basement for 6 dwelling units, would contribute 6 to the total shown for its Census Tract. In general, the more recently built residences do not have basements.

It is difficult to compare basement protection with other alternatives without numerical values of the Protection Factors of each of the facilities involved. The Office of Civil Defense has been developing a procedure to evaluate the shielding of residential basements as fallout shelters for individuals requesting that service and sending in the necessary data. As far as we know this proposed program, the Evaluation of Fallout Protection in Homes (EFPH), is not yet underway in San Jose.

While the home basement is generally the best shelter to be found around an ordinary residential building, it is none too good. Typically it has glass windows in the exterior walls and a combustible ceiling of low strength and mass. As it stands, its occupants would be threatened by fire and fumes, blast and glass-window fragments, and radioactive fallout (especially from deposits on the roof above, although for houses not completely destroyed in Nevada tests the basements were clearly the most desirable places to be if one were forced to remain sheltered after the attack. Not all homes will be ignited, and all those ignited will not burn. Home basements could constitute a good shelter potential in the "fringe" direct effects region--particularly with minor upgrading measures).

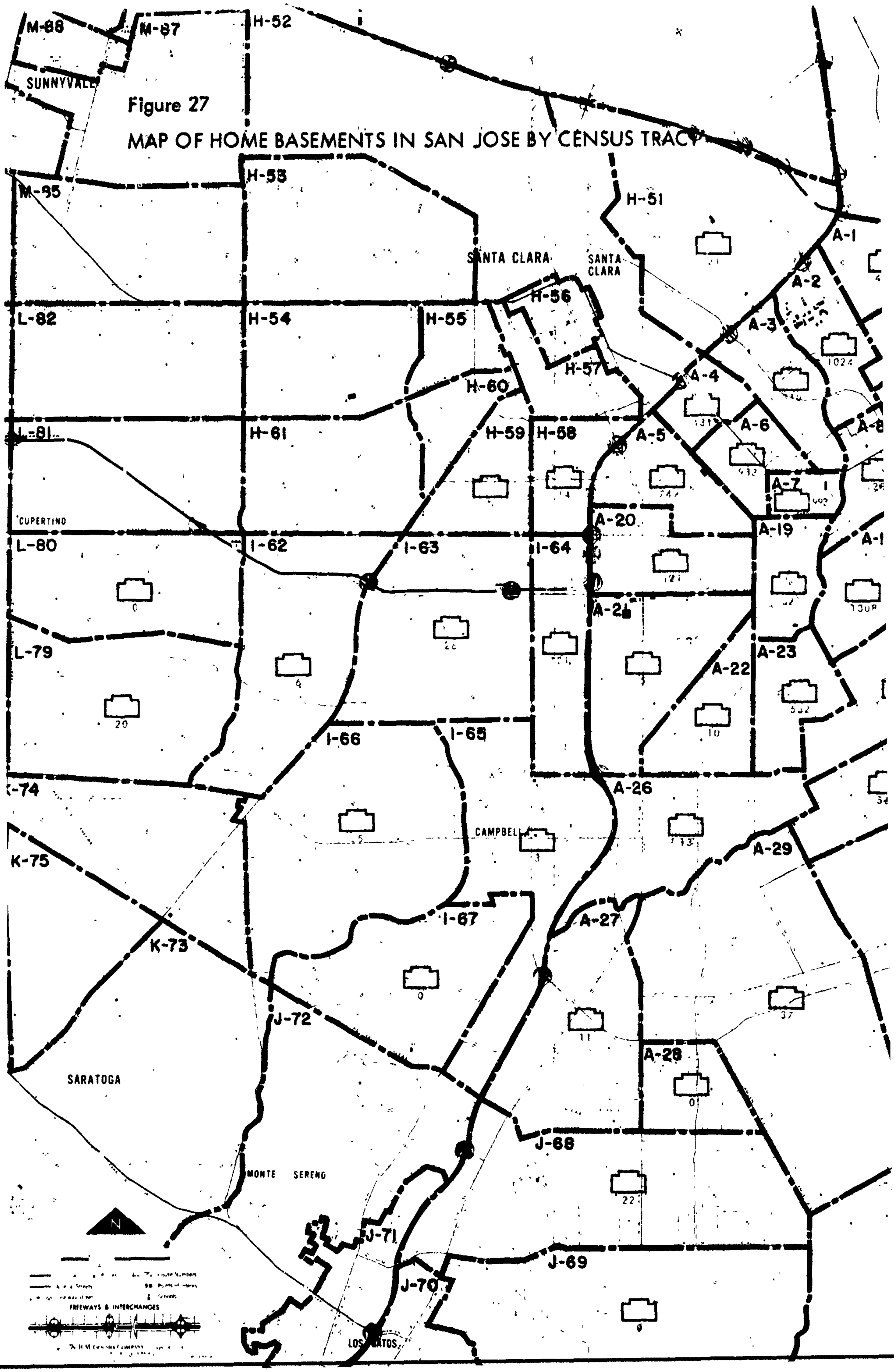
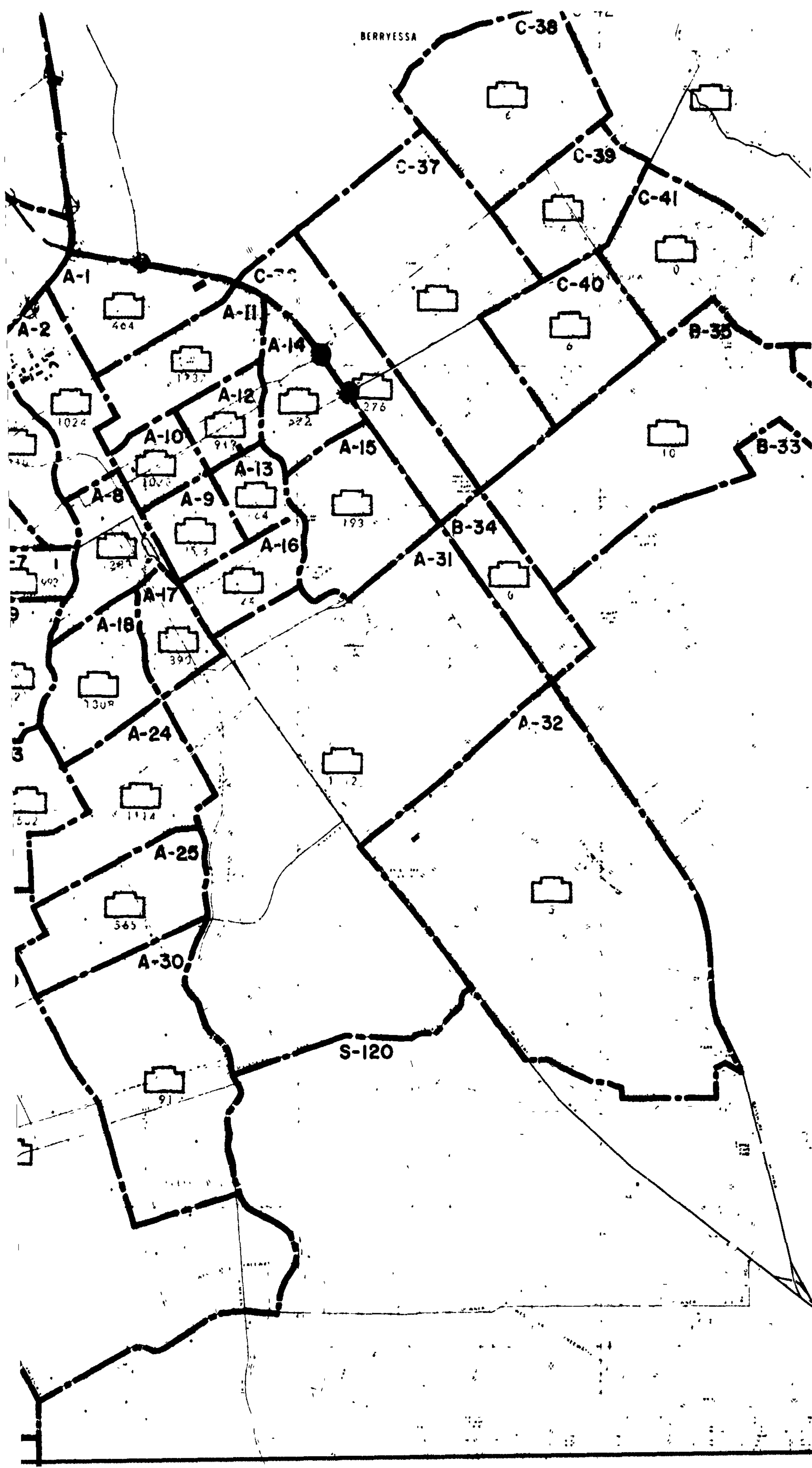


Figure 27

MAP OF HOME BASEMENTS IN SAN JOSE BY CENSUS TRACT



BERRYESSA
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A-30
S-120

Upgrading Home Basements for Shelter against Direct Effects

Because of deficiencies in protection it is natural to contemplate upgrading home basements against direct effects and fallout. Unfortunately there seem to be real barriers to getting good protection from direct effects in this way. Even when upgraded, home basements do not offer good direct-effects protection, largely because of their intrinsic vulnerability to fire.

The easiest upgrading of home basements is usually to eliminate the blast hazard from the glass in any exterior windows, and to add additional masses of earth alongside any exterior basement walls that protrude above grade. And the strength of the ceiling can be increased considerably by adding interior columns (posts or pipes) to reduce unsupported spans. After this is done, the basement inadequacies tend to be (1) inadequate overhead mass (against fallout on the roof) and (2) excessive vulnerability to fire (especially if the parent building above burns).

To support appreciable additional mass overhead, one can in principle pile the new material on the floor above (supporting it with added columns in the basement), or support it on top of a structural framework built for that purpose within the basement. The former method is simpler but may be impractical; the latter method is more complex but probably acceptable. The trouble with piling on the floor above is that large amounts of material are required. So appreciable time is required to get and distribute that material. This normally means this upgrading must be done before there is a real threat of attack. Hence one ends up with all this material on the first floor for long periods of time--a situation which may not be compatible with the normal use of that space. The alternative of putting the added mass overhead in the basement does require a supporting frame, but once it is obtained and installed it can be left without great inconvenience (except perhaps to the shelter part of the basement). Such a supporting frame can be additionally useful to prop up the basement ceiling and to provide sleeping, sitting, eating, and working space--shelter furnishings.*

In spite of these improvements, upgraded home basements remain vulnerable to mass fire. And we see no sure way to avoid this difficulty. Thus for direct-effects protection we draw a definite distinction between NFSS Basement Shelters (of reinforced concrete, including the ceiling) and ordinary home basements:

> While neither presently provides the Universal Protection against flash/blast/mass fire/fallout that is essential for direct-effects protection, NFSS Basement Shelters <u>can</u> be upgraded with low-cost modifications to provide Universal Protection; ordinary home basements cannot be so upgraded--because of their irrevocable susceptibility to fire.

This seems to end the possibilities for passive protection with existing buildings. Next we considered in this chapter the use of community drainage facilities as shelter, especially large buried conduits. They seem to offer appreciable potential as is; and that protection could be improved by adding interior ventilation and sandbagging the open ends. The value of drainage facilities for shelter is, of course, greater in arid and semi-arid regions (such as San Jose) than might be the case generally. Since we already tried to inventory all appropriate drainage facilities, we seem to have exhausted this possibility previously.

---

* A modular frame for this purpose has been developed by SRI under OCD Work Unit 1124A and will be reported elsewhere.

Natural streams, lakes, bays and oceans were taken up next as places where water shielding from direct effects and fallout might be obtained. (This possibility of shielding by immersion must be held in abeyance until proved practical.) Here again we endeavored to note everything available--so no unexploited protection seems to lie in this direction.

There followed a treatment of large incombustible open areas as places to flee from the community fire. Such places were certainly not exhausted. Enough suitable public school grounds and parks were enumerated to accommodate the entire population. But many other areas exist, and much of the rural surroundings of the City of San Jose tend to be of this character. Organizations and individuals holding such areas should alert themselves to their value for direct-effects protection.

The large open areas within the community are also the best sites for building new large shelter and/or shielding for protection from direct-effects. Only public lands and public protection were treated previously. There are also opportunities for this kind of protection for private organizations.

Future New Large Shelter/Shielding on Private Land by Organizations

We have nothing new or different to suggest as to techniques for private organizations to employ in developing large capacity protection on their own land. The procedures to use are those described earlier in the chapter. We are concerned here merely with different principal actors. Now it is the private organizations that are taking the protective action rather than local government or some other community agent. The available options are still those of Table 5, and the organizations still prepare covered trenches or bury culverts or build new limited-blast or full blast shelters (for examples of such shelters see Figures 24 and 25).

A word of caution seems necessary. Our previous public installations on selected school grounds and parks were assured of a freedom from mass fire effects by a prior selection of the building site: a suitable large incombustible open area--with a sufficient barrier from the flame front (50 yds, 100 yds or 1/4 mile) depending on the surroundings. So any organization planning a large shelter/shielding installation would do well to seek a site of comparable quality. If any of the public site requirements previously noted are not satisfied in the given situation, the organization should proceed reluctantly and carefully, watching that the total installation of shelter and normal surroundings will yet yield useful protection with adequate access. In such cases special attention must usually be given to possible degradations of the intended protection by mass fire, collapse of aboveground structures, and blast and fire debris (difficulties avoided by shelter/shielding in the interiors of large incombustible open areas).

The above seems to complete the possibilities for future new large shelter and/or shielding, mentioned for both public use on public lands, and private use by organizations on privately-owned land. Individuals and families have not yet been involved, but they would not normally be wanting large new shelters themselves; and if they band together for the purpose of making a large new shelter, they are then an organization. So we consider next the future new small shelter built on private land by individuals or families. This will be followed by future

new small foxholes and trenches for individuals and families. Neither of these has been treated before.

Future New Small Shelter on Private Land for Individuals/Families

First a word about the site for this shelter, then on to the shelter itself. Remember, this is for direct-effects protection, so we must keep clearly in mind the hazards from mass fire and its fumes when the location for this small shelter is selected. Preferably this shelter should be placed in the interior of a large incombustible open area (with a clear space barrier against fire effects of 50 yds, 100 yds or 1/4 mile as appropriate). This is the ideal arrangement, and with it success can be guaranteed. Limitations on private land holdings may not always allow such a remote installation. But do what you can with the space that is available to rid yourself or reduce the effects of mass fire. In the available space, position the shelter entrance and ventilation ports as far from any combustible materials as possible. (The shelter is assumed to be underground, or mounded over with appreciable earth.) If that clear space separation is significantly less than the 50 yds, 100 yds or 1/4 mile previously specified, then provisions should be made to be able to (1) seal up the shelter against the entry of the products of combustion; and, where fire involvement of the shelter exterior is serious and unavoidable, (2) provide breathable air from stores within the shelter for the estimated duration of the nearby fire threat. Since this latter requirement takes additional space, special materials and equipment, and a knowledgeable operator within the shelter, and is unnecessary with sufficient clear space around the shelter, it is obvious that careful consideration should be given to the selection of the shelter site. (This may be reason enough, where community civil defense is inactive, for individuals and families to band together into an organization to get enough land for the necessary clear space between shelter portals and nearest fire front--and then build a larger joint shelter with its additional advantages.)

The individual or family shelter for Direct-Effects Regions must be protective against flash/blast/mass fire/fallout. It can take many forms. We know of no catalog of all the various types that have been suggested, so we shall show a few sample designs for illustrative purposes.

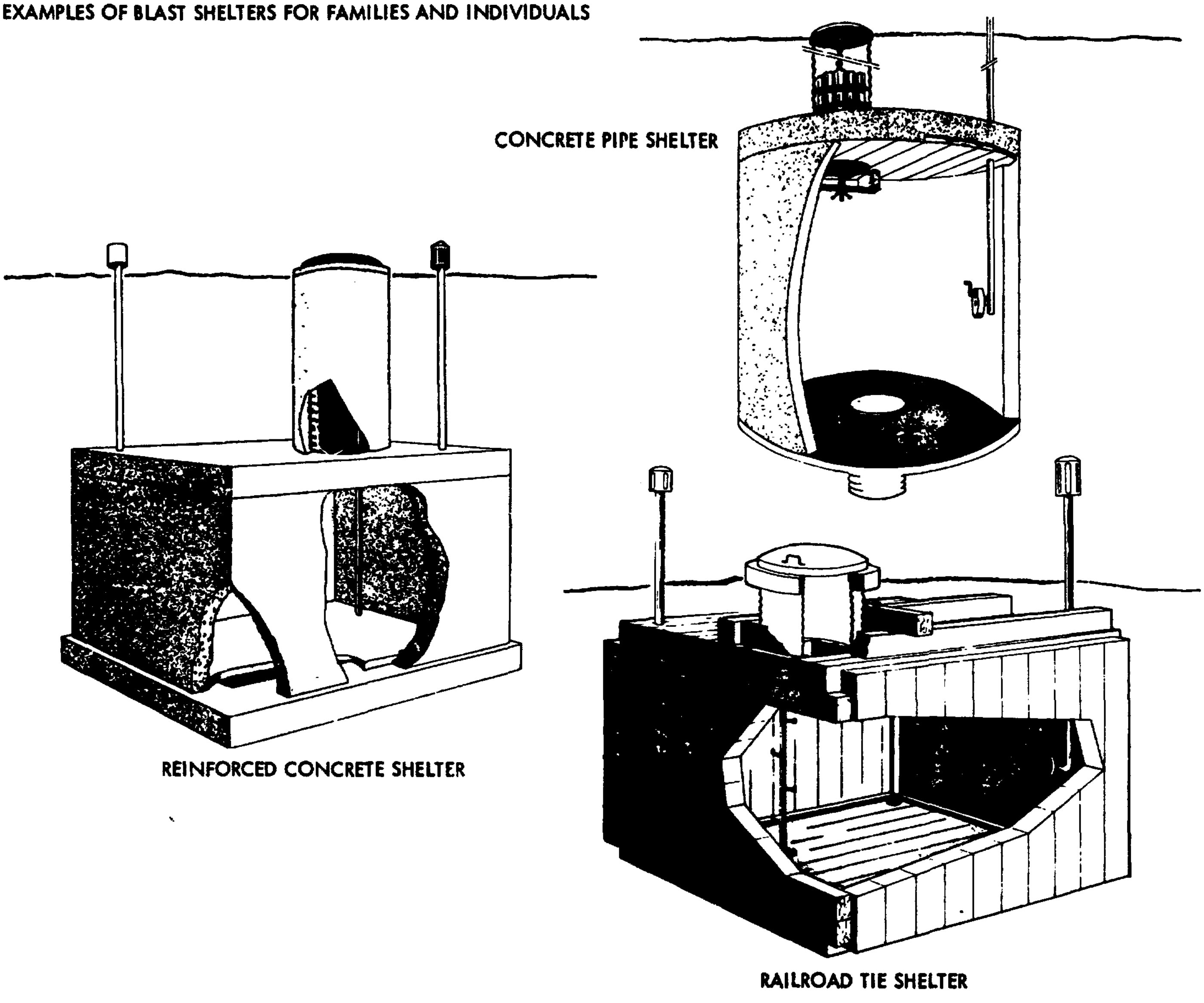
Blast Shelters for Families and Individuals. Three versions of family shelters with full blast protection, taken from an SRI publication, are shown in Figure 28. Characteristics, construction details, costs and critical evaluations are given in the original report.

Limited-Blast Shelters for Families and Individuals. Three versions of family shelters with limited-blast protection, taken from an OCD publication, are shown in Figure 29. Characteristics, construction details, costs and critical evaluations are given in the original report.

It is to be noted that semi-permanent construction appears in some of these shelters. You may recall that we took a dim view of the usefulness of such procedures for public shelter (and indirectly for the shelter for organizations). An important difference is believed to exist here between public and private shelters--largely because of different expectations and financing. Public shelters constructed in the absence of severe threat of attack are expected to last--hence permanent-type construction is almost essential. And financing such structures is so involved that this too practically dictates a permanent product. Not so with shelters for families and individuals. Families and individuals have lesser expectations of themselves; the things they build can more readily be expedient, substandard, semi-permanent. If it needs redoing later, they can redo it. Their methods of payment are relatively simple and straightforward. Of course families and individuals may wish to have permanent-type shelters, but those less permanent can also be included in their options.

Figure 28

EXAMPLES OF BLAST SHELTERS FOR FAMILIES AND INDIVIDUALS



SOURCE: Low Cost Family Shelters, Stanford Research Institute for the Office of Civil Defense, October 1961.

Future New Foxhole/Trench Shielding for Individuals/Families

We attempted to show previously that the construction of narrow trenches by public authorities (or by the public itself) in large incombustible open areas within the community constituted a "last ditch" measure to gain protection from nuclear attack (now judged imminent) for those not already better protected. If such public reactions to a real threat of attack do not occur, it is still possible for individuals and families to do so on their own--preferably with adequate guidance from local civil defense. The foxhole or trench will still provide a lot of protection for individuals and families. Here again the possibilities for protection are cramped by the limited land holdings of most individuals/families. For direct-effects protection we would like the hole or trench to be dug in large incombustible open areas--terrain not generally owned by individuals within built-up areas. Still a person can try to do the best he can with what he has.

The personal foxhole or family trench should be located in the largest available open space, as far as possible from any significant combustible materials.

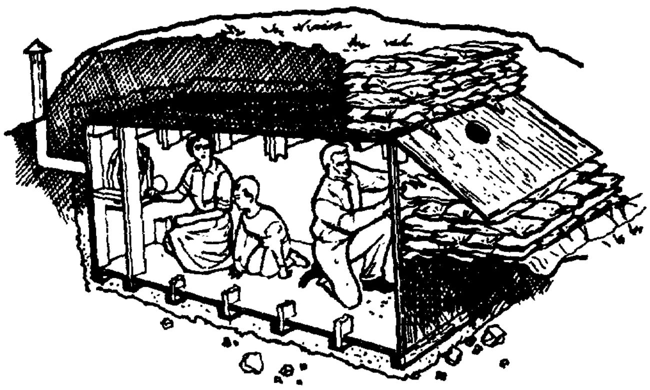
In general the excavation should be planned in its entirety now. Necessary tools should be obtained and arrangements made with any coworkers involved. Plans and materials should provide for shoring the walls of the trench, and covering it with wooden planks, plastic sheet, and earth. Layouts should be fixed on the ground. Actual construction should await a real threat of attack (unless the ground is such as to allow trenches to last a long time--in which case, dig and cover them now). Foxholes and trenches, adequately narrow and deep, well removed from the nearest burnable material, can provide significant protection from nuclear attack. Their practicality is somewhat dependent on local weather conditions. They should be more valuable in mild climates, like San Jose has, than in areas where outside conditions are more extreme.

Some individuals and families have another resource for possible use as water shielding which has not yet been included. This is the residential swimming pool. This may be of interest for protection from nuclear attack, especially in regions with a mild climate (e.g. San Jose, California).

Figure 29

EXAMPLES OF LIMITED-BLAST SHELTERS FOR FAMILIES AND INDIVIDUALS

STEEL CULVERT SHELTER



PLYWOOD BOX SHELTER

LUMBER A-FRAME SHELTER

SOURCE: Family Shelter Designs, Department of Defense, Office of Civil Defense, January 1962.

Using Existing Home Swimming Pools for Water Shielding

We introduced previously (in this chapter) the concept of direct-effects protection by total immersion of the body in water--with the head out as necessary. Protection for the head is desired, of course, and may be furthered perhaps by wet white towels and a hard hat, helmet, or inverted waste basket.

The home swimming pool seems to offer an ideal place for exploiting this approach to protection. The depth of water can be readily adjusted to suit the persons involved: Stand-up space in the deep end, sit down space in the shallow end--both with whole body immersion. And the concrete bounding walls of the pool provide additional protection. Pool occupants should back up against the wall closest to the expected enemy targets in the vicinity; the corners of the pool in that direction will generally be more protective still.

There is given as Figure 30 a map showing the distribution of swimming pools by Census Tracts in San Jose. This is based on the partial inventory of Appendix G. While most of the pools are included in these data, they are not absolutely comprehensive. Some of the older pools do not appear.

For short term protection, where nothing better is available, water shielding is known to be useful against mass fire effects. It should also be protective against flash and blast. Heavy clothes should be worn in the water for the additional warmth they bring.

For long term protection, the potential of water shielding by immersion is unknown. Attendant difficulties from the immersion itself are expected to be serious: lowering of deep body temperature, excessive loss of body fluids, collections of fluids in the lower extremities, and masceration of the skin.

We believe this approach to protection should be explored further to determine its practical limitations.

* * * * *

These are all of the potentially protective resources of San Jose (Actual), for use against direct effects and fallout, which we have been able to think of.

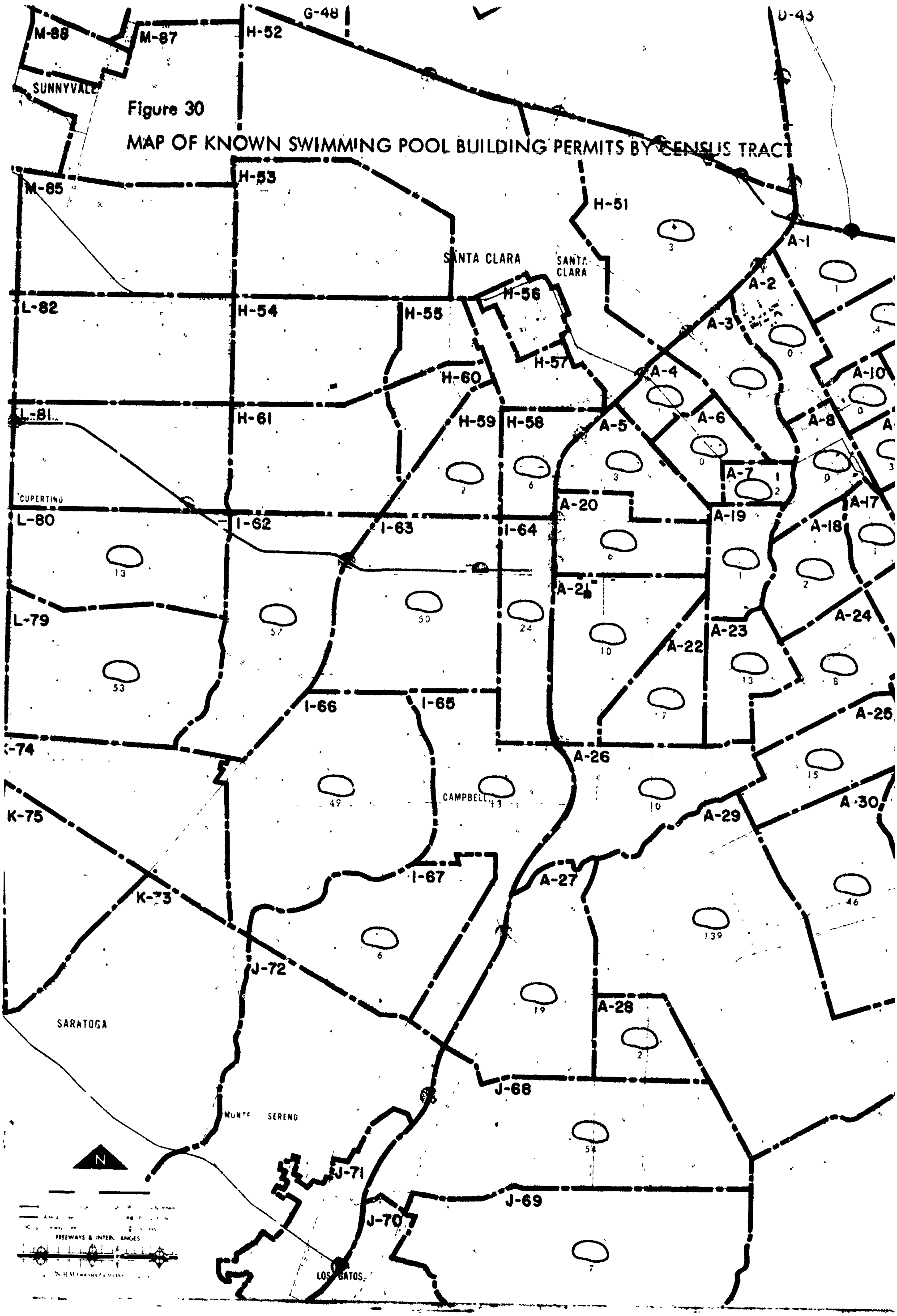
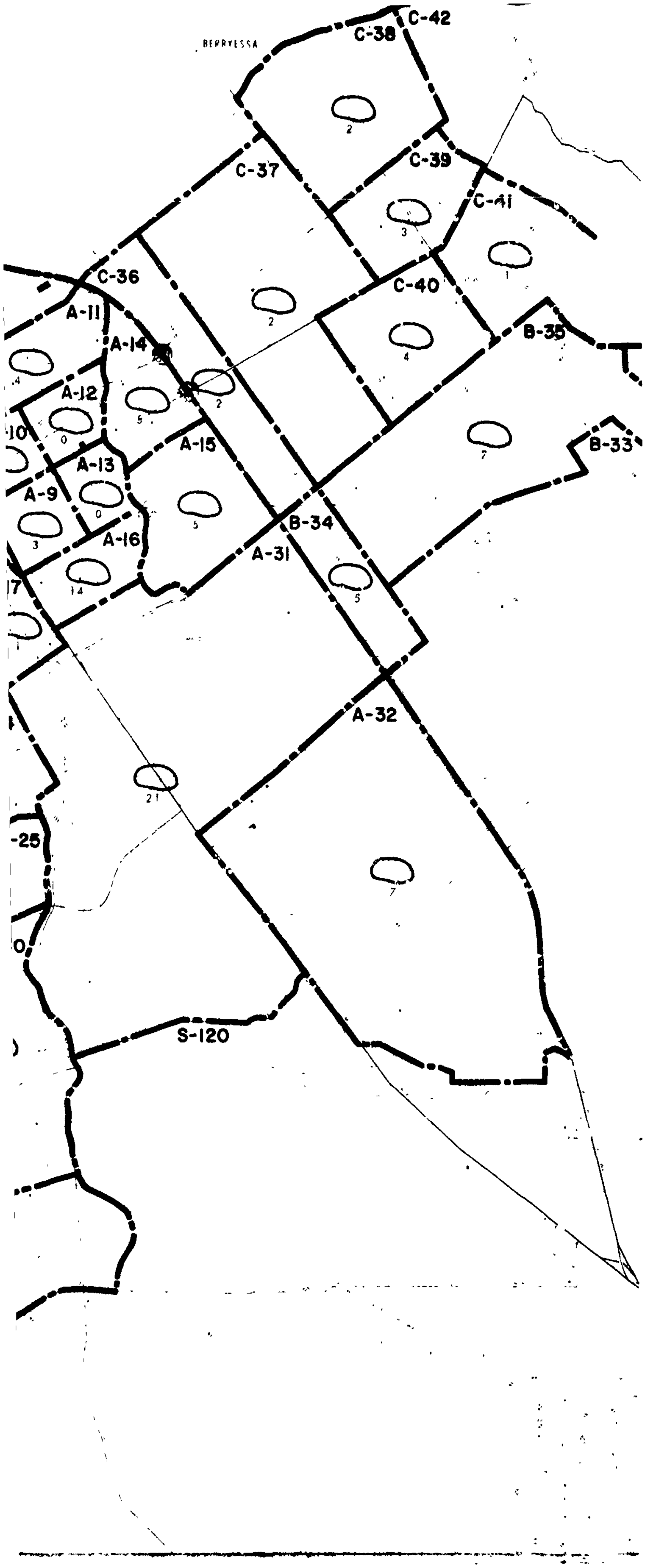


Figure 30

MAP OF KNOWN SWIMMING POOL BUILDING PERMITS BY CENSUS TRACT



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A-31
A-32
-25
S-120

SAN JOSE FIRE STATIONS AS NEIGHBORHOOD CIVIL DEFENSE CENTERS

We now leave the physical Facilities in San Jose of possible use for protection against nuclear attack, and turn to the related subject of Readiness--in particular the contribution to civil defense readiness which the local fire stations can make. What we have to say applies equally to Direct-Effects or Fallout-Only Regions.

The concept of making neighborhood fire station personnel responsible for developing civil defense readiness in their precinct was noted on p. 51 of this Volume. In essence, a local fireman (augmented as necessary for this increased responsibility) could be concerned with my preparedness to withstand nuclear attack. He could visit me personally at my home, determine my knowledge of passive protection, correct some of the misinformation he found, leave helpful pamphlets or reminders, inform me of deficiencies in my understanding and in my protective facilities, and tell me about classes to remedy the former and procedures to remedy the latter. He would be concerned--he would care, person to person.

If there was public shelter available for emergency use by me and my family, he would introduce us to it (perhaps simultaneously with some of our neighbors). He would show us how to spread the notice of warning of possible enemy attack from neighbor to neighbor, to be sure everyone was alerted. If there was no public shelter available he would tell me my options and suggest the best procedure for me to seek physical protection--both at home, and throughout the community. When our civil defense training had advanced sufficiently to be worth actual testing and critical evaluations, he would be there, caring, helping, trying to improve the chances for survival of me and my family. This fireman would be "our man" for civil defense.

This special new role for local firemen necessarily reflects back on each neighborhood fire station. They must become show places for civil defense. At his firehouse, "my fireman" can practice (and show me) everything he preaches about passive protection. He has what it takes; and he can do what is necessary. _He is ready!_ And of course he has a suitable shelter. But that shelter is not primarily a firehouse shelter; rather is it _a prototype of the shelter recommended for installation in his precinct_. (Or several different prototype shelters may be there if appropriate.) And he has the design drawings, or the information needed to purchase, and he can help with its installation if necessary, because he has been through all that himself. In short, fire station personnel (augmented) must become practicing experts on (and salesmen for) practical civil defense, complete with their kits of how to do it; and with prototype installations of community, group or family demonstration shelters (as is right for that region) at the fire house itself.

The locations of the fire stations of the City of San Jose are shown on the map of Figure 31. Available plot plans of these stations are given in Appendix G, for use in devising preliminary plans for prototype shelter installations.

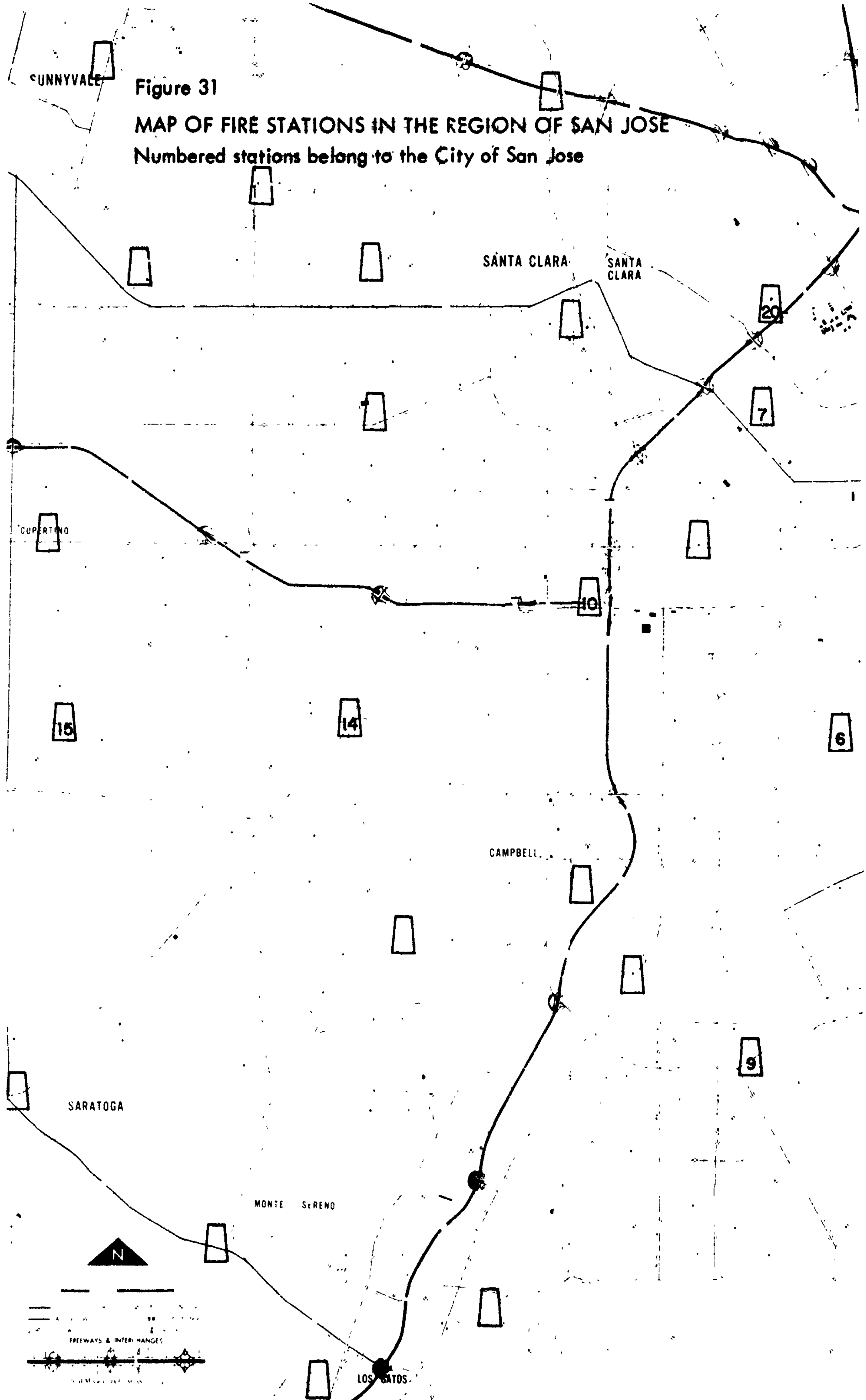
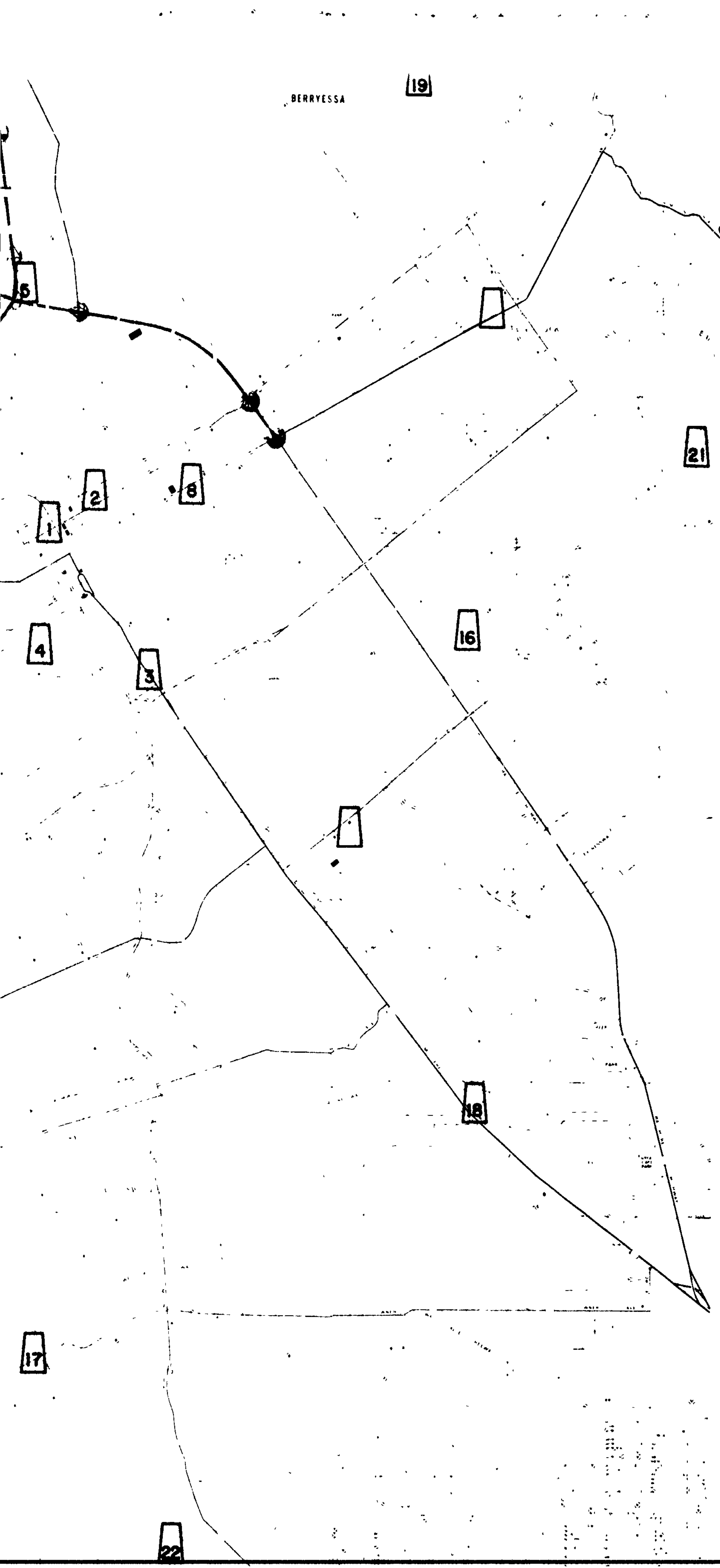


Figure 31
MAP OF FIRE STATIONS IN THE REGION OF SAN JOSE
Numbered stations belong to the City of San Jose



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NFSS FALLOUT SHELTERS, ABOVE & BELOWGROUND (PF ≥ 40), FOR SAN JOSE (FALLOUT ONLY)

It is interesting to determine how one would proceed to provide protection if San Jose were threatened solely by radioactive fallout--with a negligible risk of flash, blast or community conflagration. We consider here (and in the remainder of this chapter) the protective shelters and shielding for San Jose treated as a Fallout-Only Region.

With the nuclear weapons effects limited to just gamma radiation from fallout, the sole protective characteristic needed for shelter is a sufficient mass of material between the fallout and the people to be protected. A principal purpose of the National Fallout Shelter Survey (NFSS) was the location of such protection throughout the country. So we start our search for fallout protection for San Jose (Fallout Only) with the NFSS resultant printouts. This time we eliminate nothing from consideration, being pleased to use all spaces with similar protection factors (and habitability) both above and belowground for protection in Fallout-Only Regions.

We show on the map alongside the approximate locations of the NFSS Shelters, Above and Belowground, with capacities ≥ 50 and with protection factors ≥ 40. Neighboring shelters have been grouped together by San Jose Civil Defense into Shelter Complexes, and given an identifying Complex number. The individual buildings comprising each Complex are listed alongside by Facility Number. The actual locations of shelters in downtown San Jose are shown on the larger scale map of Figure 48. The NFSS capacity of each fallout shelter with a Protection Factor ≥ 40 is listed in the second column of capacities--CAT 2-8--of the accompanying table.

Table 6

NFSS CAPACITIES OF SHELTER COMPLEXES FOR FALLOUT PROTECTION

	FACILITY NO.		ABOVE & BELOWGROUND, AS IS			ABOVE & BELOWGROUND, VENT ADDED		
COMPLEX	LIC.	UNLIC.	CAT 1	CAT 2-8	CAT 1-8	CAT 1	CAT 2-8	CAT 1-8
1	45		0	497	497	0	1,242	1,242
	53		0	364	364	0	364	364
		63	750	158	908	750	613	1,363
	70		0	704	704	0	2,293	2,293
	73		1,029	1,583	2,612	1,029	2,401	3,430
		74	0	338	332	0	332	332
		75	0	54	54	0	230	230
	84		959	0	959	959	0	959
	85		0	1,370	1,370	0	1,570	1,570
	116		1,324	3,242	4,566	1,324	4,383	5,707
	120		350	1,978	2,328	350	2,610	2,960
	121		1,708	306	2,014	1,708	714	2,422
		122	0	88	88	0	551	551
	129		0	92	92	0	295	295
		130	173	119	292	173	312	485
		132	144	138	282	144	138	282
	138		750	518	1,268	750	571	1,321
	205		2,160	1,155	3,315	2,160	1,155	3,315
TOTAL			9,347	12,698	22,045	9,347	19,774	29,121
TOTAL LICENSED			7,674	11,809	19,483	7,674	17,598	25,272
TOTAL UNLICENSED			1,673	889	2,562	1,673	2,176	3,849
GRAND TOTAL			9,347	12,698	22,045	9,347	19,774	29,121

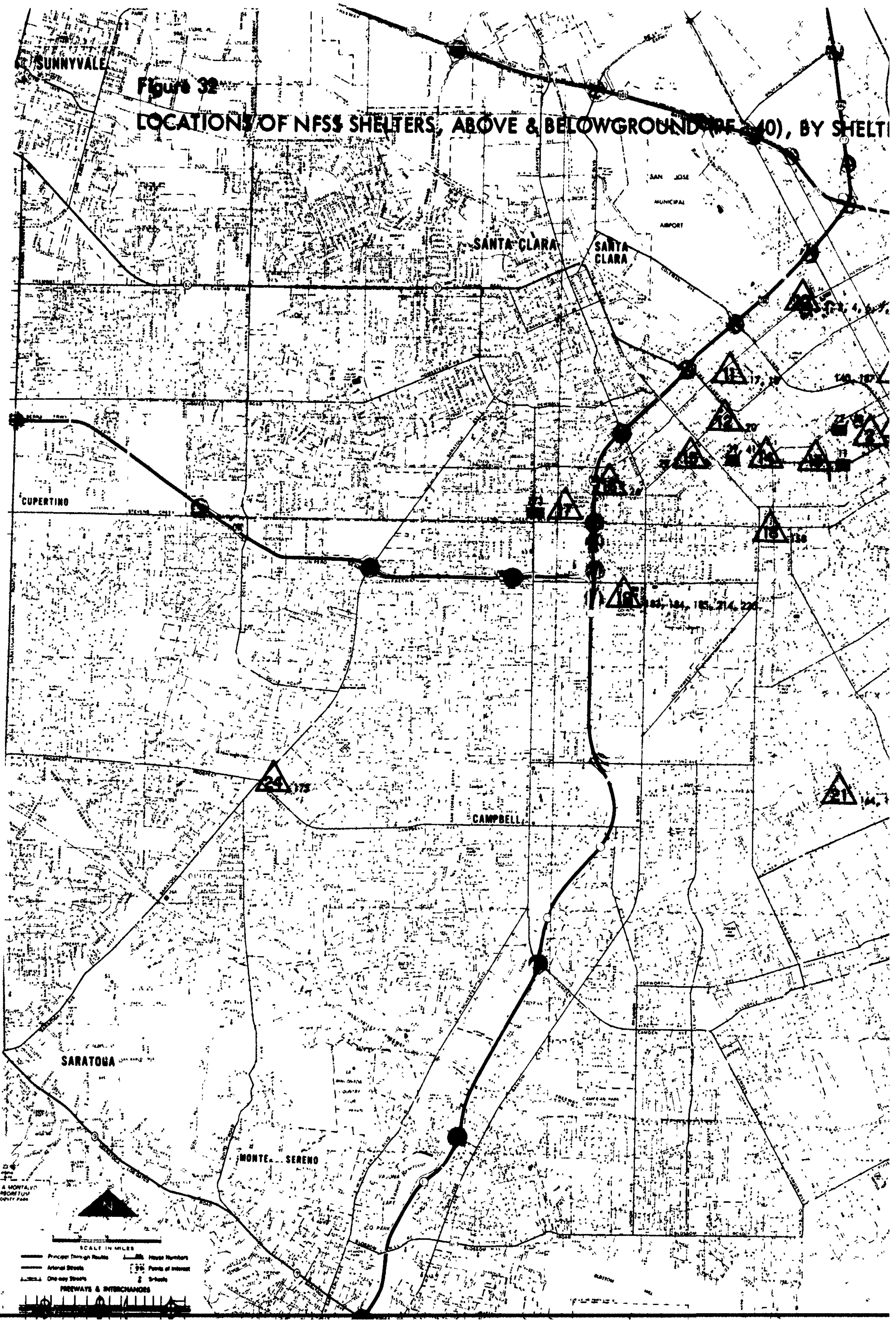
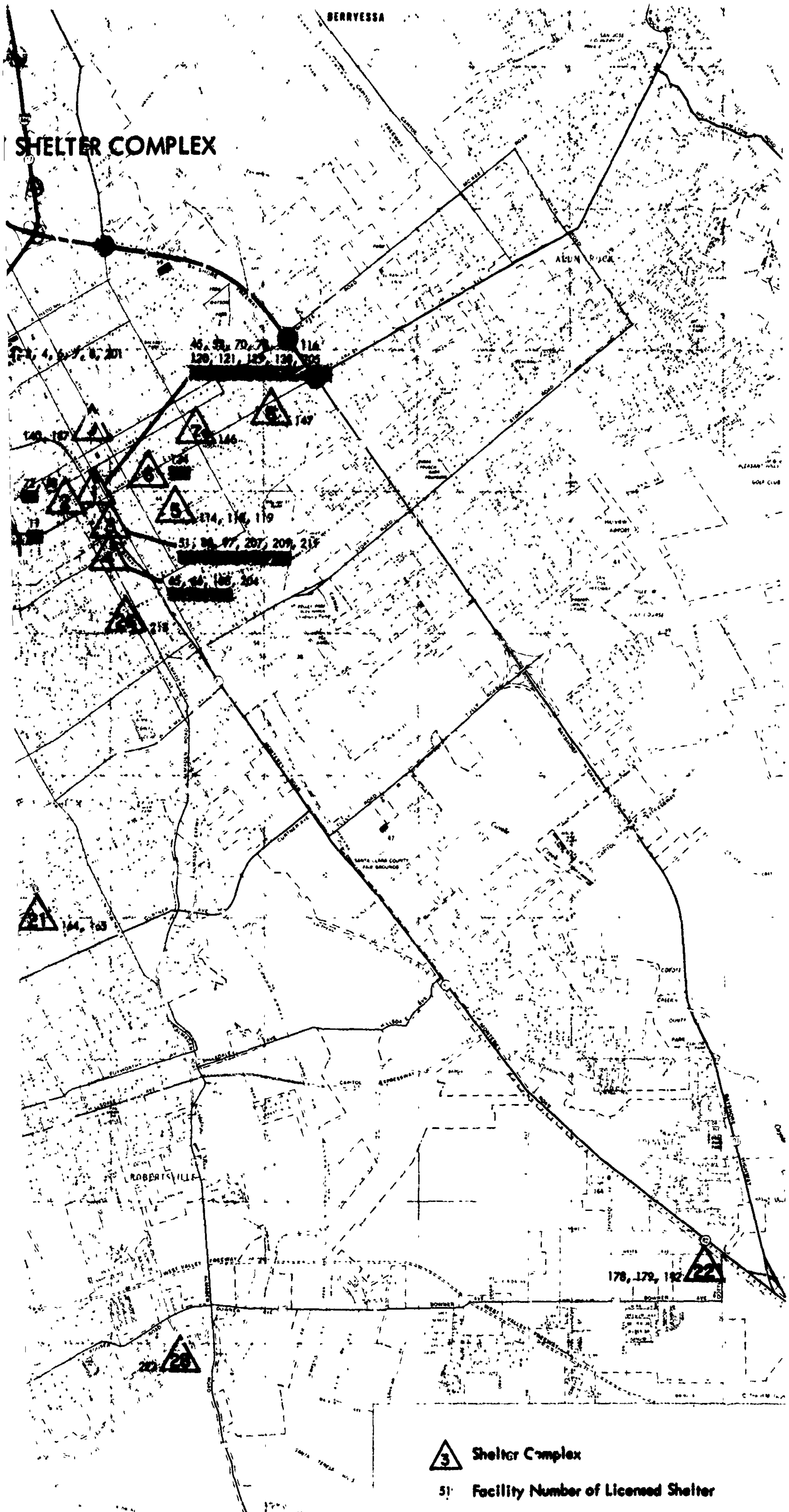


Figure 32

LOCATIONS OF NFSS SHELTERS, ABOVE & BELOWGROUND (PF ≥40), BY SHELT


SHELTER COMPLEX
BERRYESSA
ALUM ROCK
ROBERTSVILLE
Shelter Complex
51 Facility Number of Licensed Shelter

NFSS CATEGORY 1 SPACE, ABOVE & BELOWGROUND (PF 20-40) FOR SAN JOSE (FALLOUT ONLY)

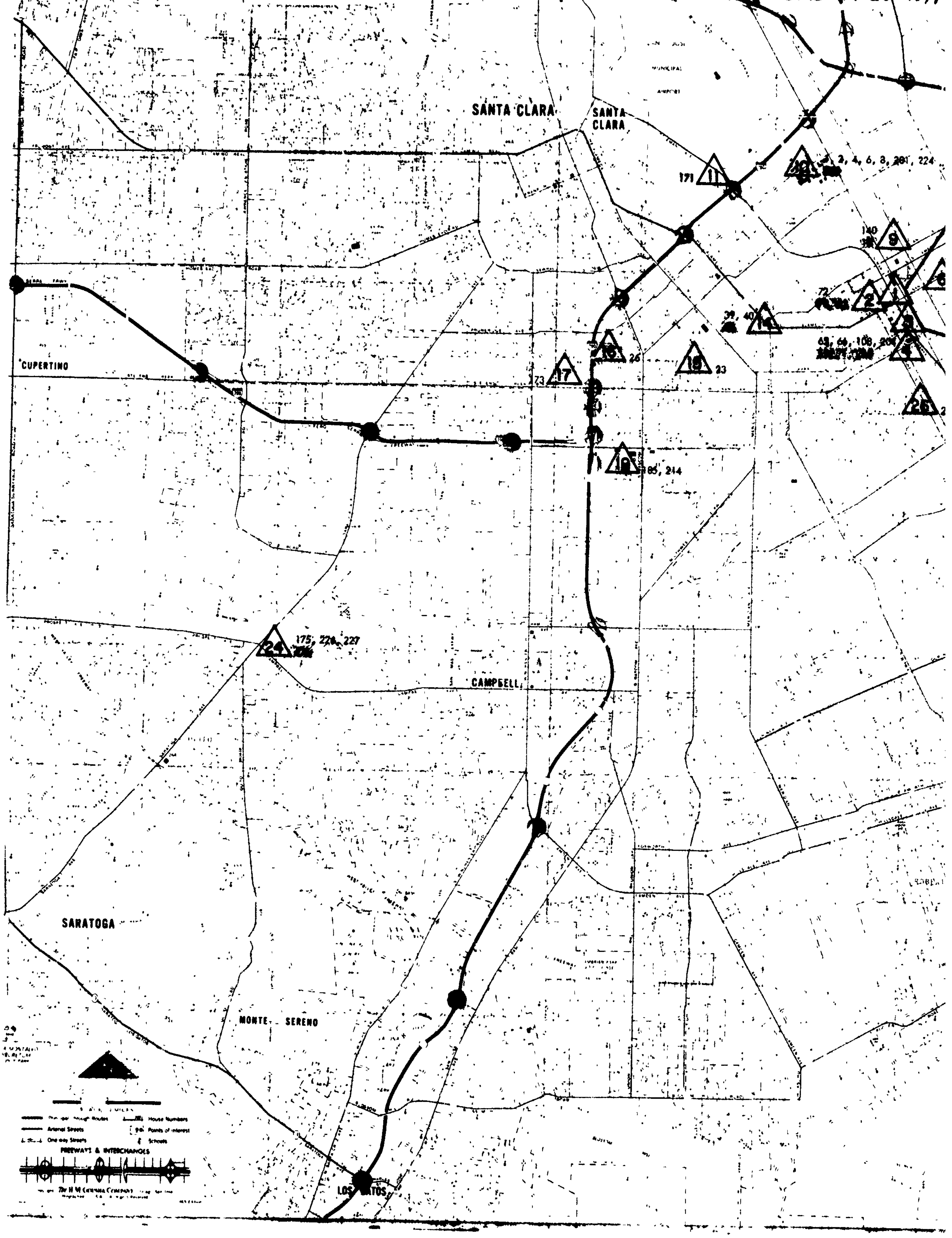
The first column of capacities in the table is for spaces in the Protection Factor Category 1 located by the NFSS and listed for consideration as fallout shelter--with Protection Factors 20-40. The distribution of these Category 1 spaces is shown on the facing map. (Actual locations of individual shelters downtown are given on the larger scale map of Figure 47.) In the absence of better shelter for the population, it may be necessary to use some or all of this Category 1 space--still a lot better than nothing. (A Protection Factor of 20 reduces the gamma-ray dose by: (1) a factor of 20 relative to a person standing fully exposed in the open, or (2) a factor of about 10 relative to a person staying at home inside an ordinary wood frame, single family residence. These may be worthwhile reductions in particular cases, though, of course, always inferior to shelters with higher PFs, other things being equal.)
The third column of capacities is the sum of the first two, the total of all identified spaces with Protection Factors ≥ 20.

TABLE 6 (Continued)

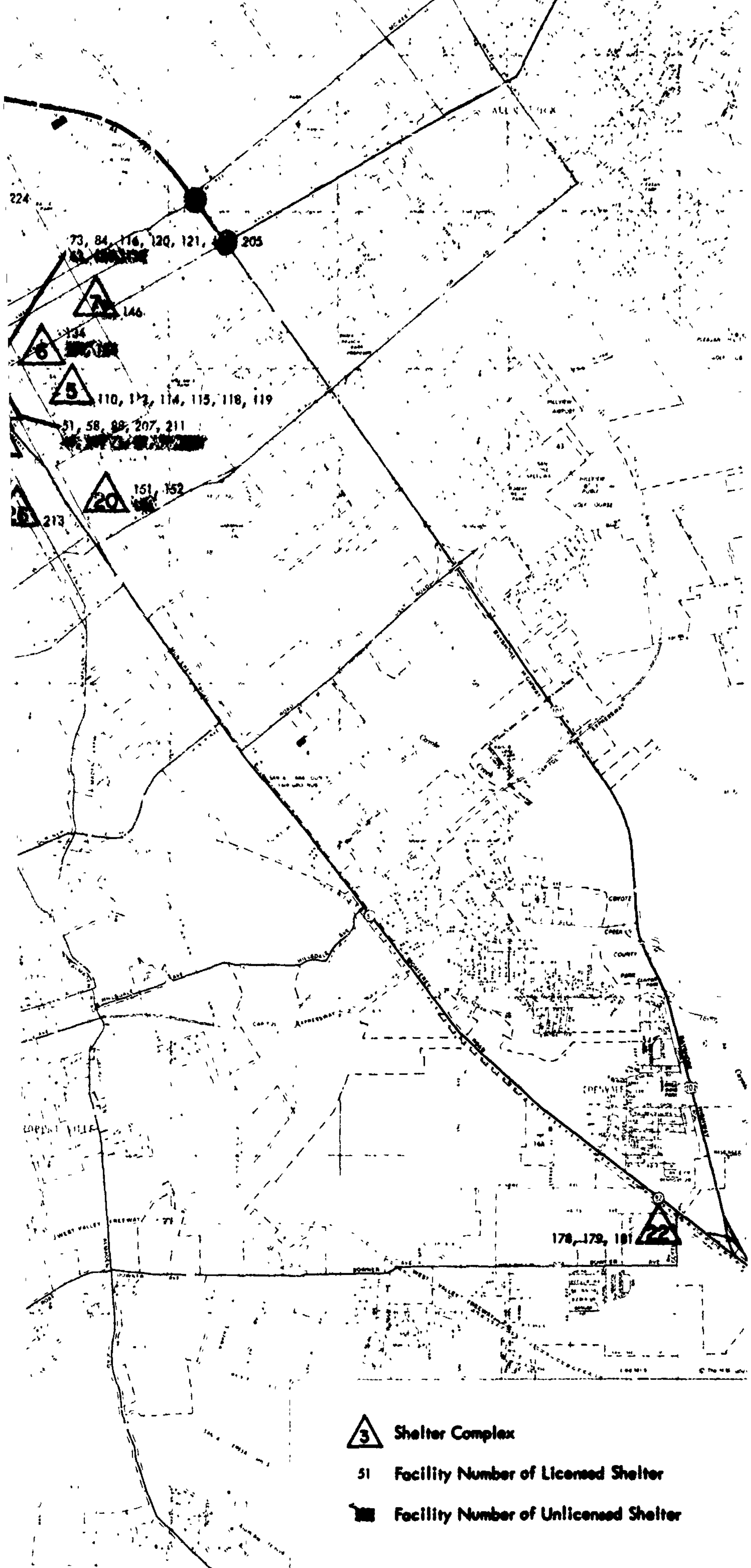
	FACILITY NO.		ABOVE & BELOWGROUND, AS IS			ABOVE & BELOWGROUND, VENT ADDED		
COMPLEX	LIC.	UNLIC.	CAT 1	CAT 2-8	CAT 1-8	CAT 1	CAT 2-8	CAT 1-8
2	72		2,592	206	2,798	2,592	852	3,444
		77	0	138	138	0	484	484
		78	55	0	55	55	0	55
		82	77	0	77	77	0	77
	93		0	115	115	0	481	481
TOTAL			2,724	459	3,183	2,724	1,871	4,595
TOTAL LICENSED			2,592	321	2,913	2,592	1,333	3,925
TOTAL UNLICENSED			132	138	270	132	484	616
GRAND TOTAL			2,724	459	3,183	2,724	1,871	4,595
3		48	292	450	742	292	892	1,184
		50	390	101	491	390	492	784
	51		1,380	173	1,553	1,380	724	2,104
	58		50	0	50	50	0	50
		87	168	0	168	168	0	168
	88		1,592	884	2,476	1,592	2,032	3,624
		93	810	536	1,346	810	1,134	1,944
	97		0	280	280	0	1,282	1,282
		100	0	95	95	0	526	526
	207		70	64	134	70	64	134
		208	339	98	437	339	494	833
	209		0	288	288	0	468	468
		211	531	58	589	531	58	589
TOTAL			5,622	3,027	8,649	5,622	8,166	11,193
TOTAL LICENSED			3,092	1,689	4,781	3,092	4,570	7,662
TOTAL UNLICENSED			2,530	1,338	3,868	2,530	3,596	6,126
GRAND TOTAL			5,622	3,027	8,649	5,622	8,166	11,193

Figure 33

LOCATIONS OF NFSS CATEGORY 1 SPACES, ABOVE & BELOWGROUND (PF 20-40),



0), BY SHELTER COMPLEX



NFSS FALLOUT SHELTERS, ABOVE & BELOWGROUND, VENTILATION ADDED, FOR SAN JOSE (FALLOUT ONLY)

As previously noted in this chapter, the NFSS included in Phase 2 estimates of additional occupants who could be sheltered (primarily in basements) if inferior ventilation rates were brought up to certain minimum requirements by providing supplemental ventilation equipment. The last three columns in the table are the enlarged capacities made possible by specified ventilation increases. Again we have summed these NFSS shelter capacities for the Protection Factor Categories 2-8 (PF ≥ 40) and for the Categories 1-8 (PF ≥ 20).

TABLE 6 (Continued)

COMPLEX	FACILITY NO. LIC.	FACILITY NO. UNLIC.	ABOVE & BELOWGROUND, AS IS CAT 1	CAT 2-8	CAT 1-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1	CAT 2-8	CAT 1-8
4		59	637	0	637	637	0	637
	65		450	345	795	450	1,728	2,178
	66		627	129	756	627	460	1,087
		71	74	0	74	74	0	74
	108		1,314	1,971	3,285	1,314	1,971	3,285
	204		360	359	719	360	359	719
		206	400	1,420	1,820	400	2,020	2,420
TOTAL			3,862	4,224	8,086	3,862	6,538	10,400
TOTAL LICENSED			2,751	2,804	5,555	2,751	4,518	7,269
TOTAL UNLICENSED			1,111	1,420	2,531	1,111	2,020	3,131
GRAND TOTAL			3,862	4,224	8,086	3,862	6,538	10,400
5	110		1,178	0	1,178	1,178	0	1,178
	112		1,452	0	1,452	1,452	0	1,452
	114		4,606	608	5,214	4,606	608	5,214
	115		8,000	0	8,000	8,000	0	8,000
	118		630	51	681	630	50	680
	119		855	1,082	1,937	855	2,108	2,963
TOTAL			16,721	1,740	18,461	16,721	2,766	19,487
6		103	270	432	702	270	432	702
		133	712	0	712	712	0	712
	134		1,175	554	1,729	1,175	894	2,069
TOTAL			2,157	986	3,143	2,157	1,326	3,483
TOTAL LICENSED			1,175	554	1,729	1,175	894	2,069
TOTAL UNLICENSED			982	432	1,414	982	432	1,414
GRAND TOTAL			2,157	986	3,143	2,157	1,326	3,483
7	146		392	506	898	392	506	898
8	147		0	300	300	0	1,050	1,050

TABLE 6 (Continued)

COMPLEX	FACILITY NO. LIC.	FACILITY NO. UNLIC.	ABOVE & BELOWGROUND, AS IS CAT 1	ABOVE & BELOWGROUND, AS IS CAT 2-8	ABOVE & BELOWGROUND, AS IS CAT 1-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1	ABOVE & BELOWGROUND, VENT ADDED CAT 2-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1-8
9		10	360	0	360	360	0	360
	140		343	343	686	343	343	686
	187		0	50	50	0	50	50
TOTAL			703	393	1,096	703	393	1,096
TOTAL LICENSED			343	393	736	343	393	736
TOTAL UNLICENSED			360	0	360	360	0	360
GRAND TOTAL			703	393	1,096	703	393	1,096
10	1		60	0	60	60	0	60
	2		2,400	1,216	3,616	2,400	1,600	4,000
	3		0	200	200	0	454	454
	4		2,031	2,355	4,386	2,031	3,653	5,684
	6		2,688	193	2,881	2,688	1,210	3,798
	7		0	85	85	0	477	477
	8		1,200	322	1,522	1,200	1,345	2,545
	201		881	858	1,739	881	858	1,739
	224		1,552	0	1,552	1,552	0	1,552
		225	324	0	324	324	0	324
TOTAL			11,136	5,229	16,365	11,136	9,597	20,733
TOTAL LICENSED			10,812	5,229	16,041	10,812	9,597	20,409
TOTAL UNLICENSED			324	0	324	324	0	324
GRAND TOTAL			11,136	5,229	16,365	11,136	9,597	20,733
11	17		0	60	60	0	337	337
	18		0	61	61	0	306	306
		171	60	0	60	60	0	60
TOTAL			60	121	181	60	643	703
TOTAL LICENSED			0	121	121	0	643	643
TOTAL UNLICENSED			60	0	60	60	0	60
GRAND TOTAL			60	121	181	60	643	703
12	20		0	134	134	0	790	790
13	11		0	760	760	0	3,780	3,780
		89	0	189	189	0	189	189
TOTAL			0	949	949	0	3,969	3,969

TABLE 6 (Continued)

COMPLEX	FACILITY NO. LIC.	FACILITY NO. UNLIC.	ABOVE & BELOWGROUND, AS IS CAT 1	ABOVE & BELOWGROUND, AS IS CAT 2-8	ABOVE & BELOWGROUND, AS IS CAT 1-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1	ABOVE & BELOWGROUND, VENT ADDED CAT 2-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1-8
14		38	1,750	106	1,856	1,750	340	2,090
	39		644	186	830	644	186	830
	40		52	0	52	52	0	52
	41		0	120	120	0	120	120
TOTAL			2,446	412	2,858	2,446	646	3,092
TOTAL LICENSED			698	412	1,110	698	306	1,004
TOTAL UNLICENSED			1,750	106	1,856	1,750	340	2,090
GRAND TOTAL			2,446	412	2,858	2,446	646	3,092
15	22		0	70	70	0	144	144
	23		182	0	182	182	0	182
TOTAL			182	70	252	182	144	326
16	26		4,553	1,328	5,881	4,553	3,456	8,009
17	173		3,805	12,619	16,424	3,805	33,187	36,992
		174	0	215	215	0	900	900
TOTAL			3,805	12,834	16,639	3,805	34,087	37,892
18	158		0	260	260	0	633	633
19	183		0	755	755	0	1,515	1,515
	184		0	187	187	0	352	352
	185		2,695	1,586	4,281	2,695	3,801	6,496
	214		83	361	444	83	361	444
	220		0	308	308	0	1,350	1,350
TOTAL			2,778	3,197	5,975	2,778	7,379	10,157
20	151		1,630	0	1,630	1,630	0	1,630
	152		239	0	239	239	0	239
		186	186	0	186	186	0	186
TOTAL			2,055	0	2,055	2,055	0	2,055
TOTAL LICENSED			1,869	0	1,869	1,869	0	1,869
TOTAL UNLICENSE.			186	0	186	186	0	186
GRAND TOTAL			2,055	0	2,055	2,055	0	2,055

TABLE 6 (Continued)

COMPLEX	FACILITY NO. LIC.	UNLIC.	ABOVE & BELOWGROUND, AS IS CAT 1	CAT 2-8	CAT 1-8	ABOVE & BELOWGROUND, VENT ADDED CAT 1	CAT 2-8	CAT 1-8
21	164		0	62	62	0	62	62
	165		0	70	70	0	70	70
TOTAL			0	132	132	0	132	132
22	178		62	113	175	62	294	356
	179		62	138	200	62	378	440
	181		59	0	59	59	0	59
	182		0	561	561	0	2,664	2,664
TOTAL			183	812	995	183	3,336	3,519
23	169		1,594	3,009	4,603	1,594	3,828	5,422
	170		0	400	400	0	400	400
	189		0	84	84	0	84	84
	216		0	745	745	0	2,329	2,329
	217		0	102	102	0	102	102
	218		108	202	310	108	202	310
TOTAL			1,702	4,542	6,244	1,702	6,945	8,647
24	175		385	2,756	3,111	385	2,756	3,111
		176	314	0	314	314	0	314
	226		1,931	0	1,931	1,931	0	1,931
	227		494	0	494	494	0	494
TOTAL			3,124	2,756	5,880	3,124	2,756	5,880
TOTAL LICENSED			2,810	2,756	5,566	2,810	2,756	5,566
TOTAL UNLICENSED			314	0	314	314	0	314
GRAND TOTAL			3,124	2,756	5,880	3,124	2,756	5,880
26	213		56	225	281	56	225	281
28	223		0	647	647	0	647	647
SJ TOTAL LICENSED			65,092	53,254	118,346	65,092	107,584	172,676
SJ TOTAL UNLICENSED			8,516	4,727	13,243	8,516	10,137	18,653
SJ GRAND TOTAL			73,608	57,981	131,589	73,608	117,721	191,329

DRAINAGE FACILITIES AS FALLOUT SHELTER/SHIELDING IN SAN JOSE (FALLOUT ONLY)

The protective resources of San Jose identified by the National Fallout Shelter Survey and potentially useful for fallout protection have now been exhausted. Let's see where we stand. We have considered identified shelters capable of holding at most 191,329 people at 10 sq ft/person. If compressing by a factor of 2 is allowed, those same facilities would accommodate 382,658 persons. The population to be sheltered is 204,200 (1960) or 317,000 (1965).

Some of the inadequacies in fallout shelter could be reduced over the years if the New Almaden Mines were to be reopened in such a way as to leave the mining tunnels suitable for permanent fallout shelter. This possibility was previously described in this chapter for shelter for San Jose (Direct-Effects). The statements there apply here as well. The idea of this joint development of a unique Special Facility should definitely be explored by San Jose officials.

We proceed now to consider other possibilities for shelter or shielding from fallout, possibilities not included in the NFSS, and possibilities that could conceivably serve usefully in a nuclear emergency to supplement the fallout protection already enumerated for San Jose.

Covered Drainage Facilities--Existing and Future

We have seen earlier (in this chapter) that buried man-sized culverts in San Jose could have a promising potential as shelter, with Protection Factors against fallout gamma-rays in excess of 1000. The map of Figure 19 and the capacities of Table 3 should be considered as defining part of our inventory of fallout protection for San Jose (Fallout Only). And the previous remarks about future new construction of covered drainage facilities for direct-effects protection apply here as well.

Open Drainage Facilities--Vertical Concrete Walls

As explained in Appendix C, where a general treatment of the concept of water shielding is given, if the below-grade, man-sized drainage facility has vertical walls, two procedures for fallout protection are possible. First, there is the general approach of whole-body immersion (necessitating $\geq 18''$ standing water). Second, there is the possibility of appreciable (but lesser) shielding on or above the surface of that standing water (but still below grade). In this latter case one could sit or stand in or over the 18" or more of water, using it as a shield against fallout on the channel bottom. With that arrangement, the gamma-ray exposure would be largely skyshine as defined by the channel walls. (A position against the wall is best.) While such shielding does not lead to high protection factors, it may be enough for regions receiving little fallout, or it may suffice for the later parts of the shelter period when much of the radioactivity has decayed away.

Thus with man-sized vertical walls on both sides, and sufficient water in the bottom, one could initially immerse himself for a high (but very wet) protection factor. Later when so much shielding was not needed one could sit or stand in the water (or on a chair or equivalent) to gain relief from the total immersion. (As mentioned earlier, we do not yet know that prolonged immersion is possible without serious damage to the body.)

The map of Figure 20 which appeared earlier showed a small amount of vertically walled drainage channel in San Jose. Its characteristics are given here in the table shown.

Table 7

CHARACTERISTICS OF EXISTING OPEN DRAINAGE FACILITIES WITH VERTICAL WALLS AS FALLOUT SHIELDING

Facility Number	Size and Type	Length (ft)	Capacity*
7a	12' 6'-8' CLC	2,000	2,400
8a	6' 6' CLC	2,100	1,260
8c	9' 8' CLC	500	450
16	6' 7' CLC	5,500	3,300
19	·8' 8.5' CLC	3,500	2,800
		Total number of open vertical-side drainage facility spaces..........	10,210

Open Drainage Channels--Sloped Concrete Walls or Natural Banks

If the drainage channels have sloping concrete walls, it is shown in Appendix C that one can no longer find a sufficiently high protection factor above the standing water in the bottom. The fallout on the slope above the water line provides too much direct gamma radiation. So the sole practical possibility for protection reduces once more to whole-body immersion (with the head out). The map of Figure 20 and the table of characteristics in Appendix B show the amount of this potential protective resource.

Similarly for the natural creeks and rivers. Total immersion is necessary for protection (primarily to reduce the direct gamma radiation from fallout within the channel--but also reducing the lesser skyshine). And for total immersion, standing water at least 18" deep needs to be provided, presumably with little cross-channel dams and continuous reservoir feed. The map of Figure 21 which appeared earlier in this chapter shows the principal creeks and rivers in the San Jose region. Appendix D documents some of their characteristics. You may recall that these streambeds are extensive enough to accommodate all of the population of San Jose. As described before for direct-effects protection, the raising of the water level of the creeks and rivers for civil defense should increase their value for parks and recreation; and the development of these streams as parks should improve their access and habitability for civil defense.

* Figures based on 10 square feet/person

NEARBY LAKES, BAY AND OCEAN AS FALLOUT SHIELDING FOR SAN JOSE (FALLOUT ONLY)

As far as immersion for protection is concerned, the remarks made under this heading when direct effects were being considered earlier in this chapter are applicable here for fallout protection. However, where the protection sought is from fallout only, other procedures are also worth considering when the water is large in expanse. The following comments then apply just to large lakes, bay and ocean.

As explained in Appendix C, when one is out on a large body of water a distance from shore of several mean free paths for fission product gamma radiations (say $\geq$ 1000 ft), the skyshine from fallout on the shores becomes negligible and one need deal only with the fallout deposited in his immediate vicinity. If a person in such a position can keep himself and his support relatively free from radioactive fallout, he will be well protected since the fallout dropping into the water will be shielded from him by the intervening water. Assuming a "clean" person and support, his protection will be good no matter what his height relative to the water surface. Thus useful protection can be obtained submerged, floating on the surface, or suspended over that surface. Hence fallout protection can be provided by immersion, by rafts, boats and ships, and by long bridges and piers ($\geq$ 1000 ft from shore)--if the person and those rafts, boats, ships, bridges and piers are maintained relatively free of radioactive fallout.

These particular observations do not seem to have any big impact on the procedures for protection in San Jose. The San Francisco Bay still seems like a good thing to avoid when nuclear emergencies are present or threatening. It is suggested however that concepts of evacuation include not only going to shelter at the coast around Santa Cruz, but getting into a suitable boat or ship (which can be decontaminated) and going right on out to sea.

FUTURE NEW FALLOUT SHELTER/SHIELDING FOR SAN JOSE (FALLOUT ONLY)

Here we can lean heavily on material already presented in this chapter for direct-effects protection. Since those previously described facilities had to be protective against radioactive fallout (as well as flash/blast/fire, not of concern here) we can always apply them here as well. The chief difference between San Jose (Direct Effects) and San Jose (Fallout Only) for future new shelter and/or shielding is <u>location</u>.

In Direct-Effects Regions we were very particular about where any community shelter or shielding was to go: it went into certain large incombustible open areas (selected schoolgrounds and parks)--to avoid the difficulties of mass fire.

> In Fallout-Only Regions we shall be indifferent to location. New fallout shelter is welcome anyplace.

Schools and Parks as Sites for Community Fallout Shelters

Oddly enough, schoolgrounds and parks may still be of principal interest as places to build community fallout shelters--not because they must be placed there to be adequately protective, but rather because schools and parks are about the only available public lands that are widely distributed throughout the community (other than streets and sidewalks). Since school grounds and parks represent conceivable building sites for new fallout protection, the reader is reminded that maps thereof appeared as Figures 22 and 23 respectively. (These show only those public school grounds and parks evaluated as suitable for direct-effects protection, and so could be supplemented by others, not shown, for fallout protection.) Plot plans of some of the school grounds and all parks indicated on those figures are given in Appendixes E and F.

Because of the latitude allowable for locating fallout shelters, we show on the two maps which follow the distribution of:

1. Major commercial places of employment, and
2. Principal government buildings in San Jose.

Private Industry as Sites for Community Fallout Shelters

The map of employment (≥ 50) is shown so that any notions of having private employers provide community shelter could be evaluated. The distribution makes it evident that a policy of protection centered around private employers would produce a distribution of shelters which was very disparate. For the places of employment are spread quite unevenly over the populated area, and too many people (as shown by the population dot map of Figure 14) would be too far from shelter. There is good reason to have employers provide fallout shelter for their employees (if none suitable is available), but shelter for the bulk of the community cannot be obtained in this way. Public measures instituted by government seem necessary for the creation of the bulk of any area-wide shelter system for San Jose.

Government Installations as Sites for Community Fallout Shelters

The map of government buildings is shown to help answer two questions: (1) Can a system of community fallout shelters be based on shelters located just at government buildings? (2) What would be the influence of high quality civil defense in government on the people of San Jose? Because of the small number of government buildings in San Jose, it seems impractical to make them the principal sites of fallout shelter for the community as a whole (their distribution does not match that of the population--Figure 14--and there are not enough of them). As to the second question, it is very desirable and may be essential to the realization of area-wide shelter systems for government agencies to develop a high state of civil defense readiness. However, the actual government installations in San Jose are not plentiful, so there is the chance that government excellence in civil defense (if attained) might be less conspicuous to the general public than would be the case in other communities more involved in government activities. Thus, those responsible for developing community civil defense in San Jose may have to concern themselves not only with making the civil defense of governmental installations high quality, but also devising ways and means of making key individuals and the general public aware of that proficiency.

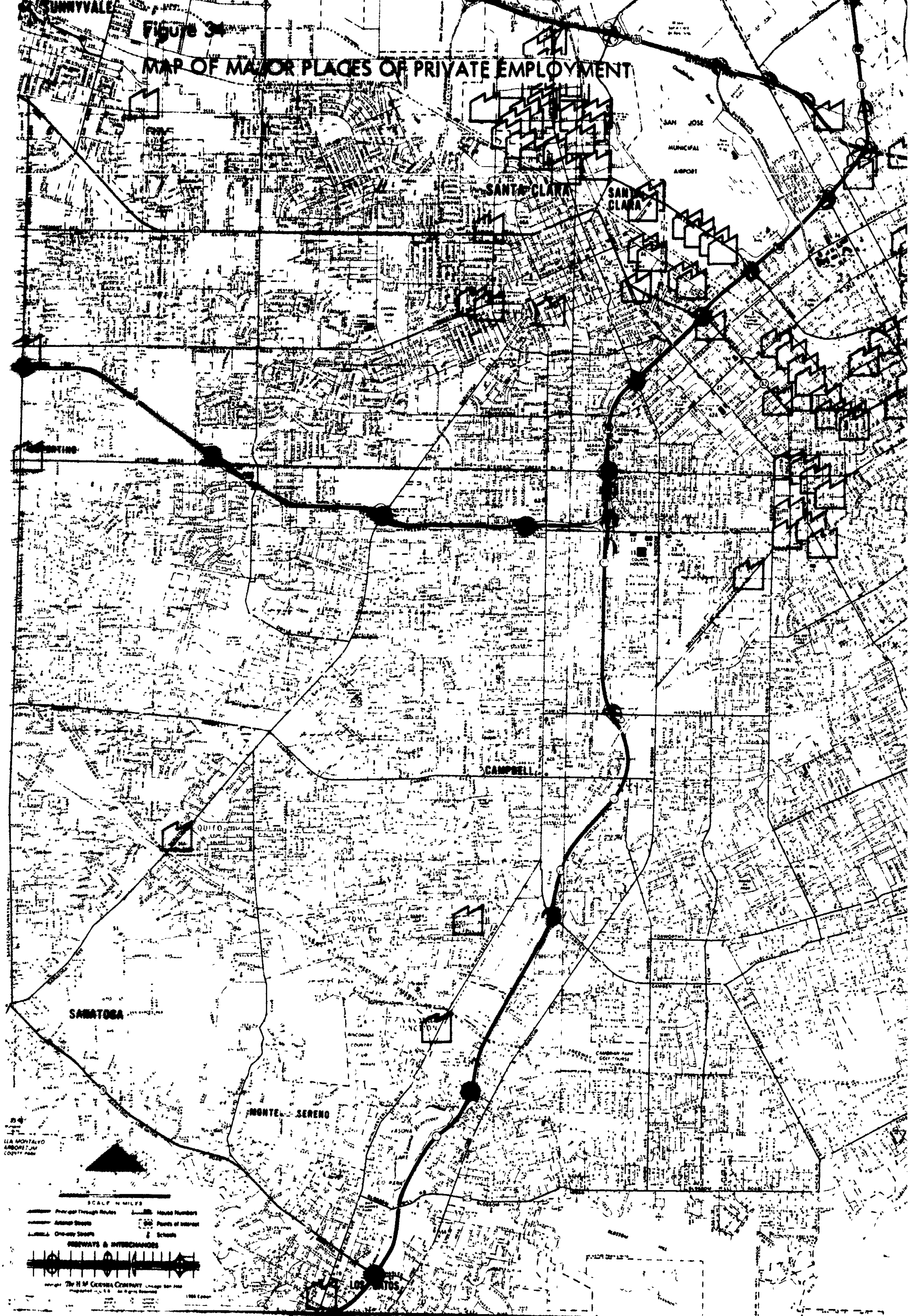
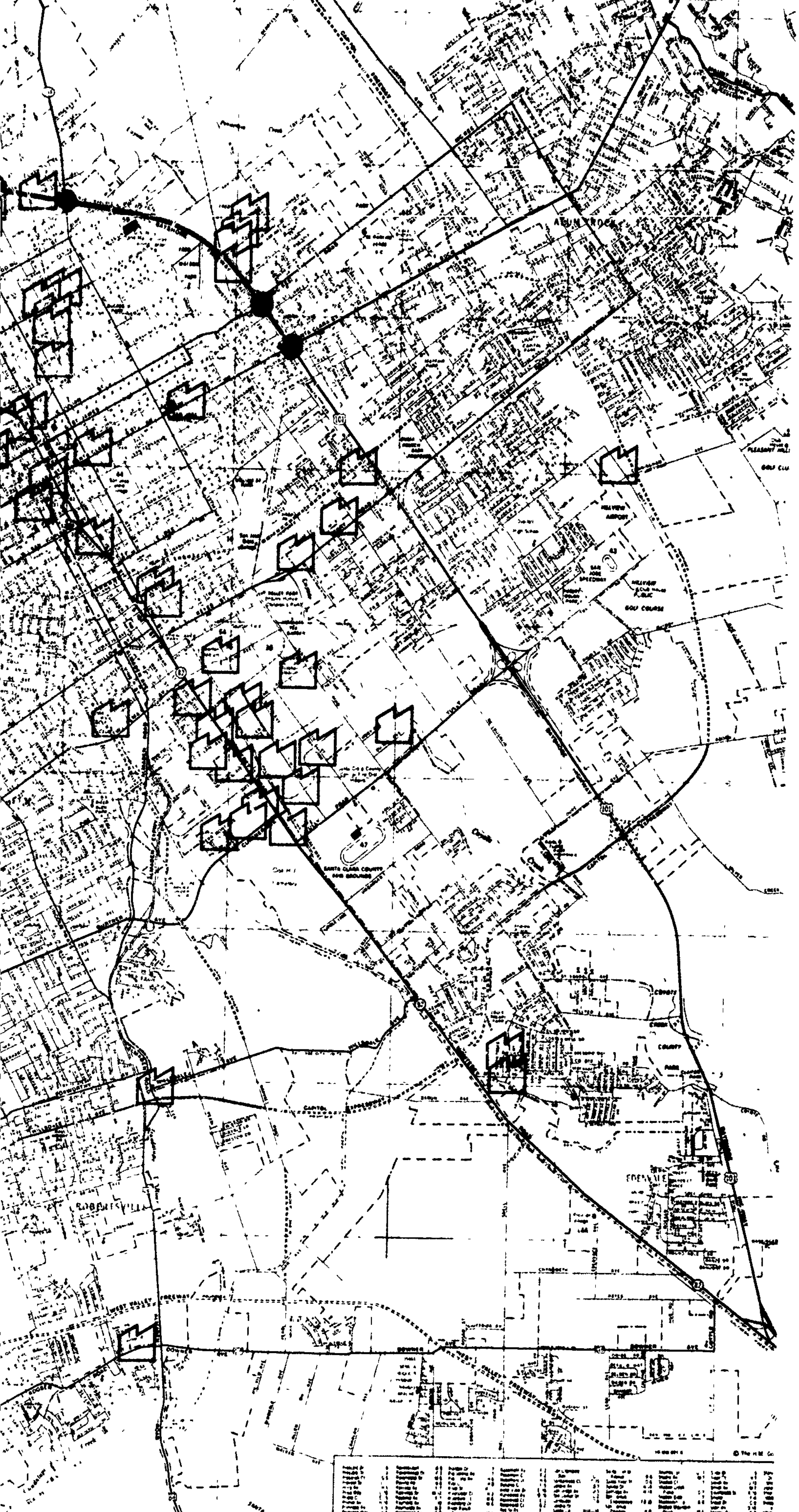


Figure 34

MAP OF MAJOR PLACES OF PRIVATE EMPLOYMENT



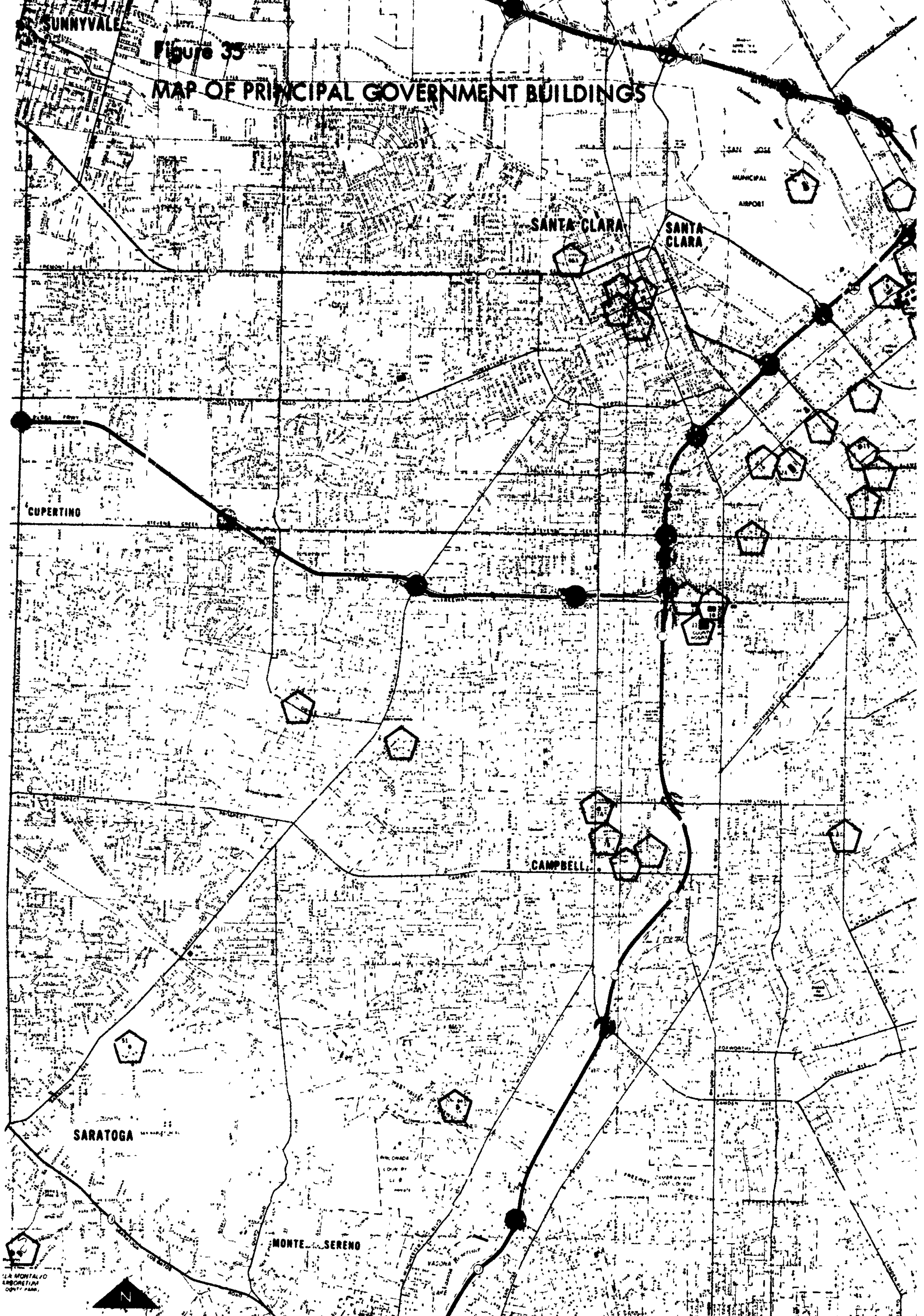
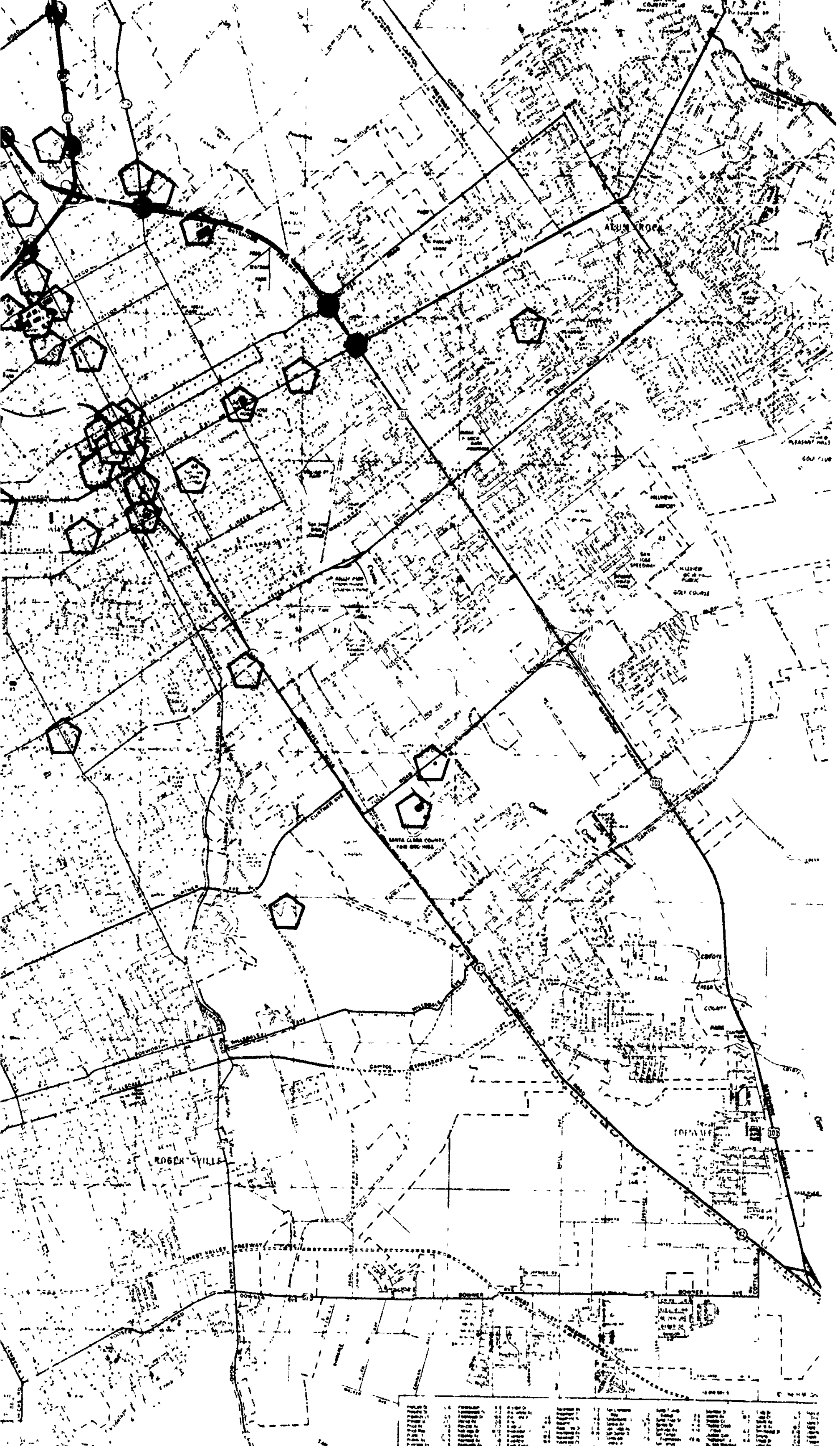


Figure 35
MAP OF PRINCIPAL GOVERNMENT BUILDINGS
SUNNYVALE
SANTA CLARA
SANTA CLARA
SAN JOSE MUNICIPAL AIRPORT
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
N
SCALE IN MILES
FREEWAYS & INTERCHANGES


ALUM ROCK

We pass on now to the specific nature of the future new fallout shelter/shielding for San Jose (Fallout Only). We will start with the crudest, cheapest possibilities, and work our way up to facilities with higher class living conditions and better protection.

Narrow Man-Sized Trenches, Shored and Covered

We saw earlier that appreciable protection from the gamma-rays of radioactive fallout can be provided by digging simple open trenches in the earth--if they are sufficiently narrow. And this humble protection can be considerably improved with wooden plank covers mounded over with the earth taken from the trench. (See Appendix C for details.) Shoring the earth walls of the trench will generally be required to increase the useful life of this expedient protection. A potent community reaction to the threat of nuclear attack would be to dig, shore and cover the earth trenches required to shield the people of San Jose (Fallout Only) not already provided with adequate shelter. Planning should be done in advance, and aimed at rapid construction on short notice. Actual construction should await a real threat of attack.

New Expedient Fallout Shelter, Semi-Permanent

As noted previously under direct-effects protection, this seems to be an unattractive option. It is not as fast a reaction to the threat of attack as trenching; and partially completed installations are of little value (while interrupted trenching will still be helpful to the extent of the trenching completed). The semi-permanent nature of the product makes the useful life too short (relative to other forms of protection) to be worth building in advance. So we do not consider this a good procedure for San Jose (Fallout Only).

New Buried Culverts as Permanent Trench Shielding

To be certain of having protection when fallout comes, the necessary facility must be provided in advance. If provided in advance it must have a long useful life--preferably permanent. If the nature of that protection is to be the humble trench-type, then there is a need for permanent trench shielding. This can be done by burying lengths of culvert in trenches. Occasional openings between the culvert sections would allow entry. These are culverts intended only for protection, not intended to carry water. Their purpose is to provide a lining for a covered trench that will not disintegrate with time (like raw earth walls). The protection from fallout is still furnished principally by the surrounding earth. Culverts (for direct-effects protection and water conduction) are examined in Appendix B.

New Limited-Blast Shelter

This type of protective facility was mentioned earlier under direct-effects protection. It is probably the highest blast protection (5-10 psi) appropriate for Fallout-Only Regions; and most fallout shelters that are newly constructed can include this amount of blast protection (at little or no additional cost) with careful designing.

In our previous brief review of limited-blast shelter designs in this chapter, we restricted our attention just to "Underground Shelter as a Separate Building"--and the example of Figure 24--since this category seemed most appropriate for use in the large open areas of San Jose for direct effects. For San Jose (Fallout Only), however a much broader range of possibilities is allowed, since we now have no real restrictions on shelter location. One can consider new limited-blast shelter as:

Shelter as a Separate Building, or

Shelter Attached to Individual Building.

And for each of these the installation may be:

Underground,
Partially Buried, or
Aboveground.

Examples of each of these possibilities have been catalogued.*

* Richard I. Condit, National Opportunities for Furthering Civil Defense through Urban Renewal and Other New Construction, Stanford Research Institute for the Urban Renewal Administration, November 1962.

Fallout Shelter in New Buildings

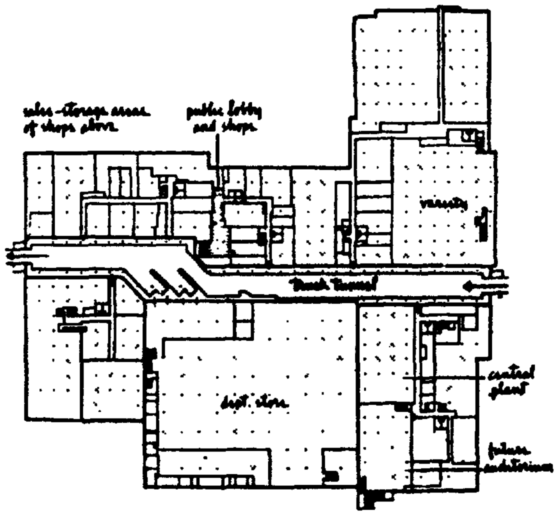
This is a powerful procedure, especially if it can be made mandatory: In Fallout-Only Regions, require new construction to provide fallout protection for the expected occupants (unless it can be shown that better protection for them is to be found elsewhere). This is a category not previously mentioned in this report as it is not especially suitable for direct-effects protection (especially when the region is already built up of ordinary structures in the form characteristic of most American communities).

A recent publication of the Office of Civil Defense describes a number of new buildings which have been constructed with fallout protection.* Included are 17 schools, 3 administration buildings, 3 communications centers, 2 parking garages, 2 fire stations, and 1 each: police station, apartment house, public utility facility, office building, and church.

Additional design approaches for making shelter integral to individual buildings have been recorded for apartment buildings, motels and hotels, office buildings, stores, service buildings, warehouses, light industrial buildings, schools, local government buildings and facilities, hospitals, churches, libraries and university buildings.**

As an example of fallout shelter incorporated in new buildings, there is shown in the next column the VALLEY FAIR SHOPPING CENTER, complete with delivery truck tunnel--convenient for functional purposes and one of the best shelters in San Jose.

AERIAL PHOTOGRAPH



BASEMENT

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* New Buildings with Fallout Protection, Office of Civil Defense, TR 27, January 1965.

** Richard I. Condit, National Opportunities for Furthering Civil Defense through Urban Renewal and Other New Construction, Stanford Research Institute for the Urban Renewal Administration, November 1962.

OTHER POSSIBILITIES FOR FALLOUT PROTECTION IN SAN JOSE (FALLOUT ONLY)

The possibilities for fallout protection which yet remain and which should be included in our survey of San Jose (Hypothetical) will be considered here. To place them in context we will intersperse these new entries with brief reminders of the possibilities already presented previously.

> The search for fallout shelter started with data for suitable spaces in large buildings and "special facilities" supplied by the National Fallout Shelter Survey (NFSS). Potential shelter capacities were shown with and without prescribed supplemental ventilation. Except for the necessary updating, this information appears to exhaust the possible shelter in <u>large</u> buildings and "special facilities." Not included is the fallout shelter in smaller buildings (capacities <50) and home basements. These will be treated now.

Smaller Structures Survey for Fallout Shelter

This program is planned by OCD but has not yet produced useful information for San Jose as far as we can determine. When these data appear, they should be injected into the inventory of community resources for use in fallout protection.

Home Basements as Fallout Shelter

The approximate distribution of home basements according to the 1960 Census has been shown previously as Figure 27. As fallout shelter there is nothing wrong with home basements that additional massive materials cannot remedy. As they stand they usually have a Protection Factor of at least 10. Their weakness tends to be inadequate mass in the basement ceiling for the gamma-radiation from fallout on the roof, and inadequate mass in the basement walls and windows projecting above the ground.

A program for the "Evaluation of Fallout Protection in Homes" (EFPH) is planned by OCD, but as far as we know has not yet produced useful results for San Jose.

Upgrading Home Basements as Fallout Shelter

Procedures for upgrading home basements for better fallout protection were outlined previously in the corresponding direct-effects part of this chapter. They consisted of adding mass (usually earth) to the outside of abovegrade basement walls and window wells, and increasing the overhead mass within the basement. This latter procedure seemed best done with a special structural frame within the basement—also useful as a base for shelter furniture.

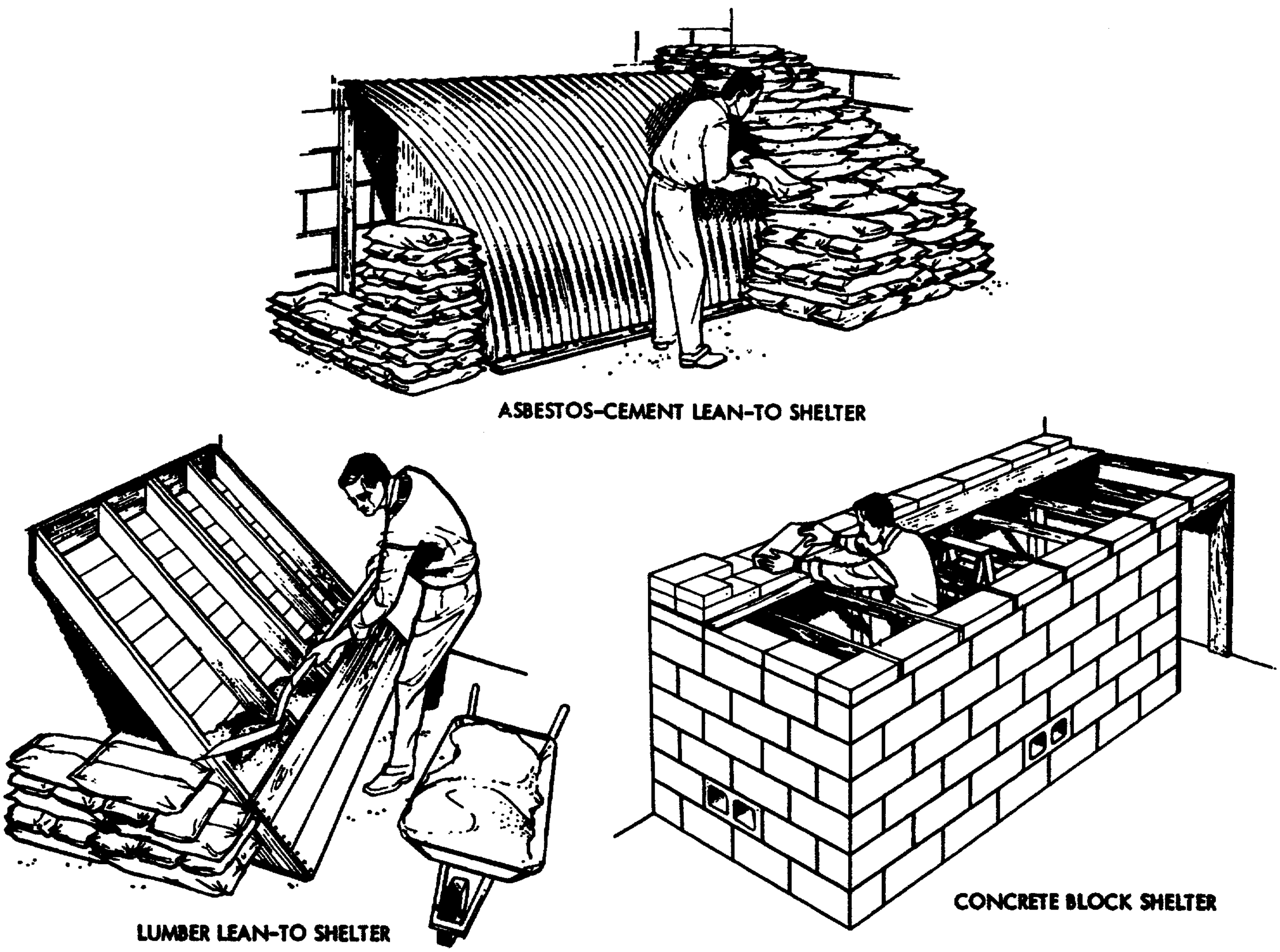
> **With suitable low-cost modifications—chiefly additional mass alongside and overhead—ordinary home basements can be readily upgraded to become satisfactory shelter in Fallout-Only Regions.**

Building Expedient Fallout Shelter inside Homes

Since there is no serious fire threat in Fallout-Only Regions, one can consider constructing expedient shelters within the inside of houses—especially within basements that are not satisfactory for shelter as built. Figure 36 shows some examples of this approach, taken from suggestions by OCD.

Figure 36

EXAMPLES OF EXPEDIENT HOME FALLOUT SHELTERS TO BE BUILT INDOORS



SOURCE: Family Shelter Designs, Department of Defense, Office of Civil Defense, January 1962.

No other possibilities for using existing buildings as fallout shelter come to mind. Next we looked at drainage facilities as fallout shelter--especially pertinent for arid and semi-arid regions, like San Jose. Drainage facilities seem to have been used up already. Then we considered natural streams, lakes, bays and oceans for shielding by immersion (if that proves feasible for the long term in mild climates); and for special conditions where banks are vertical or remote, and gamma-ray shielding from fallout may be found on or over the water. This possible approach to protection also seems to have been covered completely by previous material (in this chapter).

There followed the possibility of fallout protection from the future new construction of large public shielding/shelters on public property (and recall, fallout protection can be safely constructed anyplace). Obviously, private organizations may wish to consider similar action on their own lands.

Future New Large Fallout Shelter/Shielding on Private Land by Organizations

Since fallout shelters do not require large clear-space barriers (to protect them from the mass fire in Direct-Effects Regions), the provision of shelter or shielding by private organizations is under no handicap (as to suitable site) relative to similar acts by public agencies. So organizations desirous of creating protection can consider the same alternatives already indicated for community action: covered trenches (last ditch effort to respond to a definite threat of attack), (or with longer term planning and a peacetime construction program) new buried waterless culverts, or new limited-blast dormitory-type shelters (for example, see the previous Figure 24).

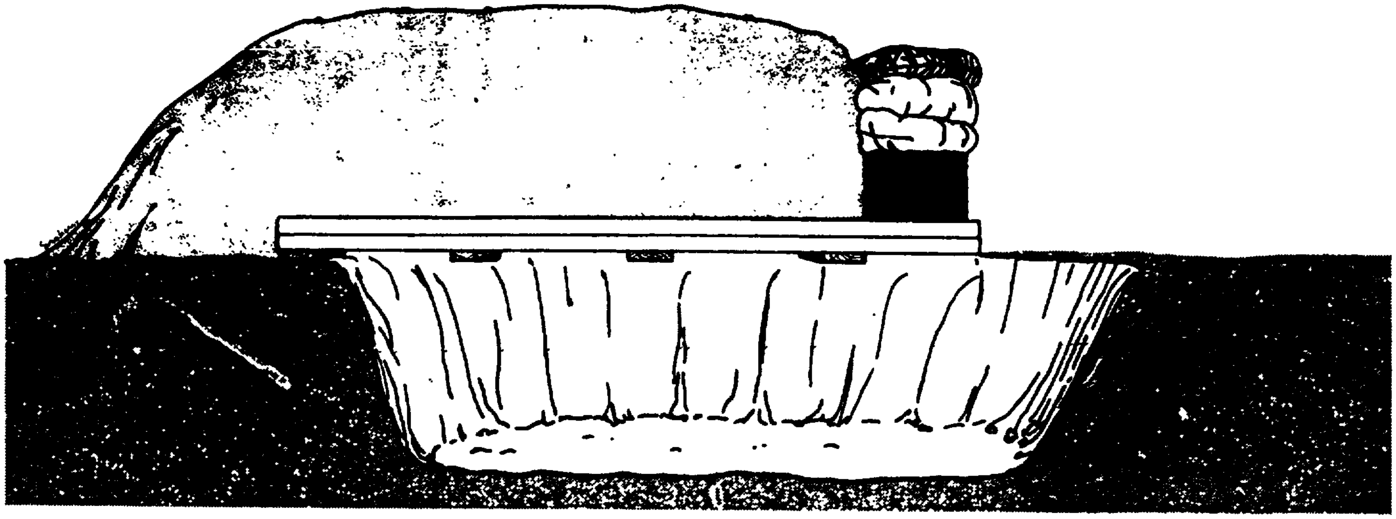
This seems to be all the requirements for future new large shelters/shielding. However, families or individuals may need the protection of small shelters/shielding--especially if there is no suitable public shelter in their vicinity and no local program to develop some.

Future New Small Fallout Shelter on Private Land for Individuals/Families

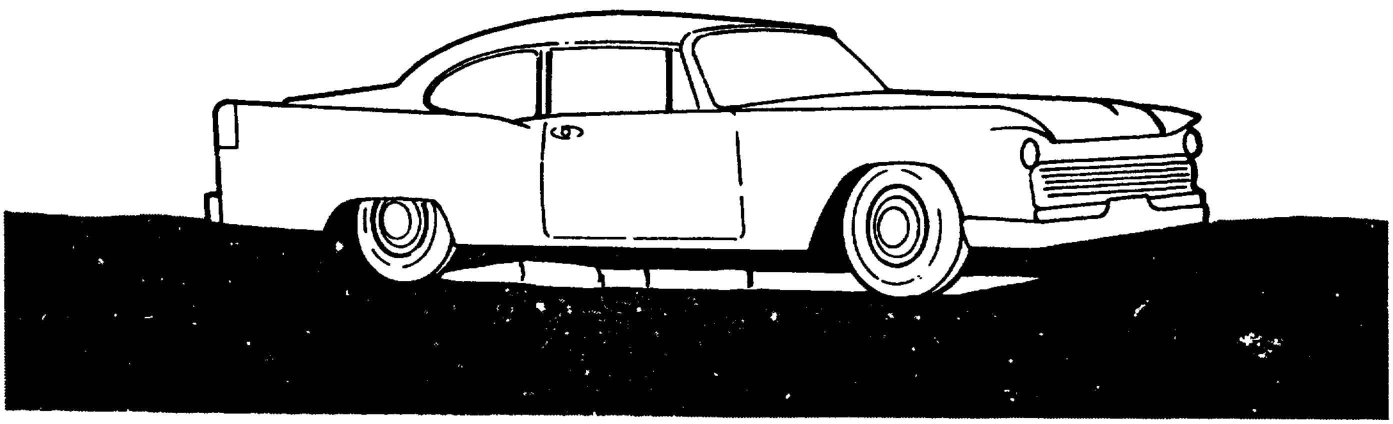
The kind of installation involved here is exactly the same as that described previously for "Limited-Blast Shelters for Families and Individuals" under the direct-effects section of this chapter. Illustrative examples were given in Figure 29, and pertain here as well. The cautions given previously about a suitable site for such home shelters do not apply here. In Fallout-Only Regions, these new small shelters can be built wherever it is convenient to have them.

Future New Fallout Foxhole/Trench Shielding for Individuals/Families

Here, also, the indifference of fallout protection to location relative to the combustible parts of the community relaxes site requirements. These foxholes or trenches can go anyplace: in the middle of the yard, alongside the house, out in an empty lot, in the crawl space under a frame house with no basement. Their practicality will be increased in mild climates which are arid or semi-arid. They can be made strong and given a limited blast resistance, as were the covered trenches described previously in the direct-effects part of this chapter. Or they can be more lightly constructed, as suggested by the examples of Figure 37.



DOOR SHELTER



CAR-OVER-HOLE SHELTER

SOURCE: Low Cost Family Shelters, Stanford Research Institute for the Office of Civil Defense, October 1961.

Using Existing Home Swimming Pools for Water Shielding from Fallout

Lastly there is the possibility, as mentioned previously for direct-effects protection, of using backyard swimming pools as emergency shelter from fallout. The number and distribution of most of such pools in San Jose were shown earlier as Figure 30. Constant immersion of as much of the body as possible provides the best protection from the fallout gamma radiation, as described before.

In addition, however, for Fallout-Only Regions one can consider other possible configurations--at least for temporary relief from the total immersion. In or near the corner of the pool (to reduce skyshine) one would have appreciable protection floating on the surface of the water; and if the water level was lowered, one might even lie above the water surface (on a float) or stand/sit (on a chair) with much of the body out of the water. Care must be taken in all this not to let appreciable parts of the body project above ground level for long.

Again it may be necessary to note that the success of protection by long term immersion is in doubt, at this time, because of the deleterious effects of the immersion itself. Developmental efforts to make water shielding practical seem needed.

* * * * *

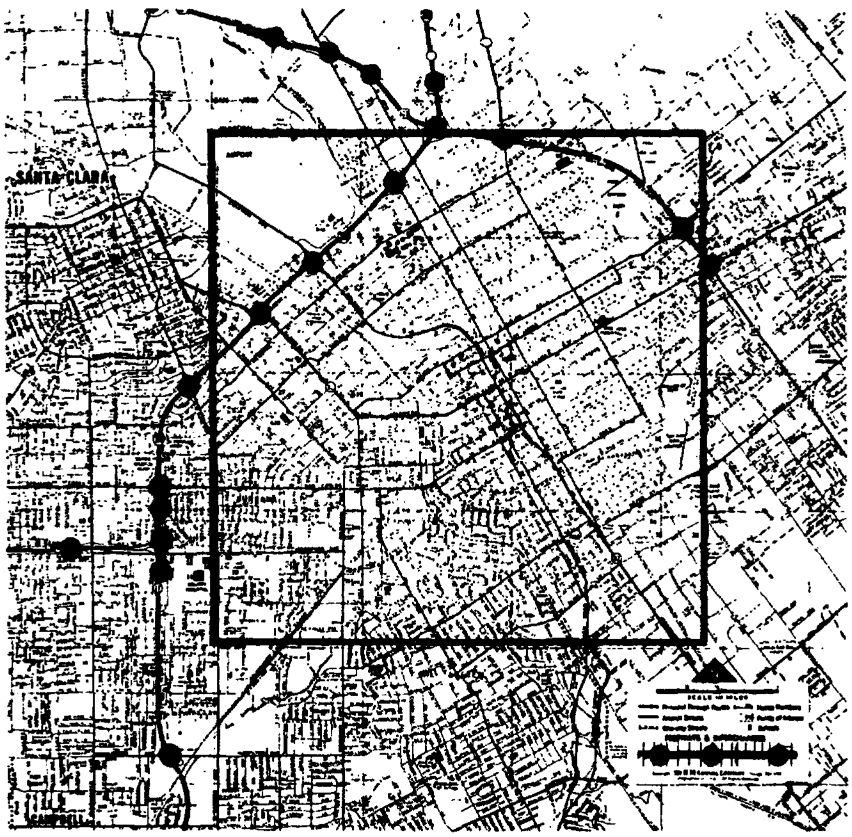
This concludes the inventory of potentially protective resources for San Jose considered as a Fallout-Only Region.

V PROTECTION PLANNING ELEMENTS JUST FOR DOWNTOWN SAN JOSE

For orientation purposes, we show below that region of the street map of San Jose (used throughout the preceding chapter) which will appear on the map of downtown San Jose to be used in this chapter.

Figure 38

REGION COVERED BY STREET MAP OF DOWNTOWN SAN JOSE



SPECIAL HAZARDS OF DOWNTOWN SAN JOSE (DIRECT EFFECTS)

There appears on the opposite page a map which includes the central business district of San Jose. It is drawn on a scale allowing more detail to be shown than our standard street map of all of San Jose. A capacity for greater detail is needed for our evaluations of the special hazards connected with the downtown area. These special hazards only arise in Direct-Effects Regions. For Fallout-Only Regions no separate detailed determination of excess hazards is necessary for any special part of the community involved.

The special hazards (from the direct effects of nuclear explosions) associated with a highly built-up area, e.g. downtown San Jose, involve personal mobility and mass fire effects. At high overpressures ($\geq$ 10 psi) in Direct-Effects Regions there is a strong chance of people indoors being trapped--being unable to get out--whatever the nature of their surroundings. If they can get out, there is a high probability in built-up areas that their mobility outside will be severely restricted by poor access conditions (caused by blast-created debris from normal buildings)--except in regions containing only single-family dwellings, well separated from each other, along with fairly wide streets. These Light-Residential Areas may thus have postattack characteristics significantly different from Heavier-than-Light-Residential Areas immediately after the nearby nuclear explosion. At high overpressures survivors who are, or who manage to get, outside tend to be:

1. Immobilized by blast-created debris in Heavier-than-Light-Residential Areas.

2. Free to move (albeit perhaps with difficulty) in Light-Residential Areas.

Thus there is a reason in built-up areas to distinguish light residential from heavier construction because of the different mobilities these two regions are likely to allow immediately postattack. At high peak pressures, these immediate blast effects seem to be the controlling ones.

At lower blast pressures (2 and 5 psi), somewhat similar consequences result, but they are slower to appear, depending as they do on the developing community postattack fire. In this case, the immediate debris from blast is unlikely to trap a lot of people indoors, and their mobility outside may not be much affected. However, once the postattack community fire gets raging (perhaps within 20 minutes or so after attack), the differences between light-residential and heavier-than-light-residential construction assert themselves again in the built-up areas. Because of the great concentration of combustible fuels in the Heavier-than-Light-Residential Areas, augmented in many cases by narrow streets and negligible set-back of buildings behind property lines, the all-consuming flames may make the streets impassable. At low overpressures survivors who are, or who manage to get, outside tend to be:

1. Immobilized by the heat and other mass fire effects in Heavier-than-Light-Residential Areas.

2. Free to move (albeit perhaps with difficulty) in Light-Residential Areas.

Thus we find another reason to delineate regions characterized by heavier-than-light-residential construction. At low peak pressures, mass fire effects seem to be the controlling ones.

We show then in Figure 40, the significant areas within San Jose which may contain heavier-than-light-residential construction. These areas were originally obtained from zoning maps, so they are permissive, i.e. these are the areas where heavier-than-light-residential construction is allowed. Whether heavier-than-light-residential construction is actually present must be ascertained by field survey, recent aerial photography or Sanborn Maps. We have relied heavily on the latter two to determine the actual buildings in those areas of San Jose zoned for construction heavier-than-light-residential.

Figure 39

STREET MAP OF DOWNTOWN SAN JOSE

Mobility Restrictions from Direct Effects for Heavier-Than-Light-Residential Construction

Within the built-up region of San Jose with heavier-than-light-residential construction--shown in Figure 40--the following planning factors are suggested (in the absence of prior fallout):*

At 10 psi and greater peak overpressures, outside movement is difficult or impossible immediately postattack. (It is still assumed to be possible to move about in Light-Residential Areas, unless the streets are very heavily lined with large trees.)

At 2 and 5 psi peak overpressures, outside movement is still possible until the postattack fire rages. This means there are at least 20 minutes before the streets become impassable. (Even at the height of the fire, movement along most streets of Light-Residential Areas is generally possible although difficult. Where the streets of Light-Residential Areas are heavily lined with large trees, movement may be impossible.)

Mobility Restrictions for Regions Receiving Heavy Fallout

For planning purposes it is assumed that radioactive fallout (from megaton weapons) does not generally descend on large areas until at least 15 minutes after the causative nuclear explosion occurs; and it is unlikely to be present in really dangerous amounts over widespread areas until at least 30 minutes have elapsed.*

Combined Mobility Planning Factors

Within Heavier-Than-Light-Residential Areas, if movement is possible immediately postattack, we assume there are at least 20 minutes before that movement may be terminated by mass fire effects and there are at least 15-30 minutes before that movement should be terminated because of radioactive fallout.

Within Light-Residential Areas exposed to direct effects, movement will generally be possible postattack, (although perhaps with difficulty at high overpressures, and may be impossible with too many big trees). In the absence of severe radioactive fallout (or other subsequent attacks) the duration of movement is unlimited. This is the case for Attack No. 1 of the Five-City Study, a non-contaminating air-burst over Moffett Field. If the damaging nuclear explosion is contaminating, then in the area receiving heavy fallout it may be necessary to stop movement and be sheltered in 15-30 minutes.

Use of Available Mobility to Escape Mass Fire

Survivors in downtown San Jose who were unsheltered, or in shelters vulnerable to mass fire, when they experienced the direct effects of a nearby nuclear explosion, will generally be driven into the streets by the postattack fire. We have seen from the above that, in the absence of fallout, they have 20 minutes or so for movement in Heavier-than-Light-Residential Areas and an indefinite time for movement in Light-Residential Areas. Their question: Where can they move to escape the all-consuming fire in the 20 minute/indefinite time period available to them? The answer: They can find succor from deadly mass fire effects either:

1. Within Universal Protection shelters that remain standing and which they can get into (in spite of blast debris blocking the entrance and prior occupants preventing entry).

2. Within the interiors of large incombustible open areas within the community.

3. Within quiet standing water sufficiently deep for whole body immersion.

It is the second of these that offers the most general solution for non-contaminating explosions (and no further attacks)--as in Attack No. 1 of the Five-City Study. And those open areas are also the preferred sites for future new public shelters providing Universal Protection. Suitable open areas in downtown San Jose will be shown presently, in Figure 42.

Figure 40

DOWNTOWN AREAS WITH CONSTRUCTION HEAVIER-THAN-LIGHT RESIDENTIAL

POTENTIAL FIRESTORM AREAS IN DOWNTOWN SAN JOSE (DIRECT EFFECTS)

The best advice we can get* suggests that firestorms are not likely in Light-Residential Areas of American communities, as normally built. Hence we have not had to consider such extreme fire dangers in previous chapters of this report. However, in the central business district of San Jose there is an appreciable region with heavier-than-light-residential construction (see Figure 40). So one wonders: Within the Heavier-than-Light-Residential Area of San Jose, given adequate exposure to the direct effects of a nuclear explosion, is a postattack firestorm likely to develop or not? To make this determination seems to require a detailed evaluation of the combustible characteristics of the downtown region.

The interim criteria for predicting fire storms given by Rodden, et al,* are:

Fuel loading	≥	8 pounds of combustibles per square foot of fire area
Fire density	>	50% of structures in fire storm area on fire simultaneously (for practical purposes, initial fire density)
Surface wind	<	8 miles per hour at time of attack
Fire storm area	>	0.5 square miles
Unstable atmosphere	+	(i.e. tends to be a favorable condition for fire storms)
Stable atmosphere	–	

In planning protection, the employment of this table reduces to a determination of community areas larger than 0.5 square miles which have 8 pounds or more of combustibles per square foot.

* R.M. Rodden, F.I. John and R. Laurino, Exploratory Analysis of Fire Storms, Stanford Research Institute for the Office of Civil Defense, May 1965.

Within the Heavier-than-Light-Residential Area of Figure 40, we need to determine the fuel loading building-by-building, by noting building areas and numbers of floors, and calculating the implied pounds of combustibles. Such detailed building information for extensive built-up areas (and only extensive built-up areas are involved) is usually obtained from Sanborn maps. From the fuel loading per building and the percent of the land occupied by buildings one can estimate fuel loadings for the region of interest. And those portions (if any) of the region where the fuel loading equals or exceeds 8 pounds per square foot can be delineated. If, then, one finds areas greater than 0.5 square miles with 8 pounds of combustibles per square foot or more (distributed fairly uniformly), those areas are the places where fire storms may develop in case of nuclear attack.

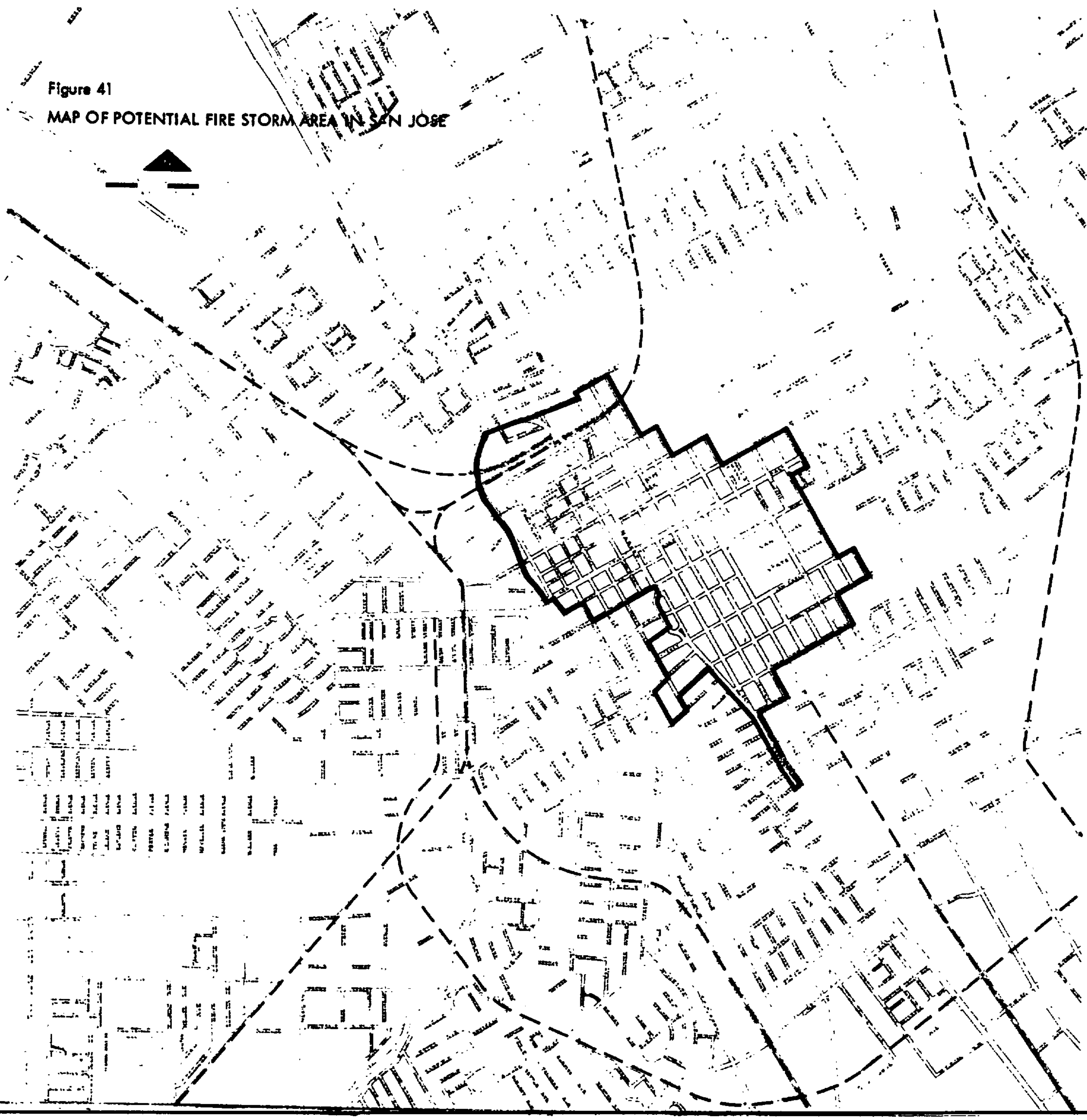
To estimate the potential firestorm area in San Jose, detailed calculations of the fuel loading were made on a few sets of typical blocks in the built-up part of downtown, as represented by the Sanborn maps for San Jose. This presumably gave a "feeling" for the appearance of blocks (on Sanborn maps) having certain approximate fuel loadings. The entire downtown San Jose region as covered by Sanborn maps was then scanned, block by block, and a rough boundary drawn for a fuel loading of about 8 pounds per sq ft. This boundary becomes the outer limit of the potential firestorm area, if it encloses an area greater than 0.5 square miles. The boundary is shown on Figure 41. The area enclosed is 0.85 sq miles. Thus a firestorm is potentially possible in downtown San Jose. The significance is:

1. NFSS Basement Shelters within the potential fire storm area are presently considered unsuitable candidates for upgrading against fire. Only future new structures specially built as shelters can conceivably qualify as protection within the firestorm area (and this approach should be used only when necessary).

2. The standoff distance, of clear space beyond the extent of the firestorm, required for relief from firestorm effects, is taken to be about 1/4 mile.

Figure 41

MAP OF POTENTIAL FIRE STORM AREA IN SAN JOSE



USEFUL OPEN AREAS IN DOWNTOWN SAN JOSE (DIRECT EFFECTS)

As temporary refuges from mass fire effects and as permanent building sites for future new shelters offering Universal Protection, we are interested in the large incombustible open areas in the vicinity of downtown San Jose. The open areas that exist can be located on maps and aerial photographs, and checked in the field. Around the outside of each prospective plot a barrier of free space must be left sufficiently wide to protect the people within from the nearest possible flame front. The empirical relations used in this study for this protective barrier space were:

Nature of Surroundings	Standoff Distance
Separate, single-family, light frame houses	50 yards
Continuous row or multistory construction (no fire storm)	100 yards
Firestorm boundary	1/4 mile

Open areas downtown which are big enough to accommodate such periferal barriers and still leave sufficient interior space to be useful are shown on the map on the facing page. The influence of the potential firestorm area on these useful open areas was as follows:

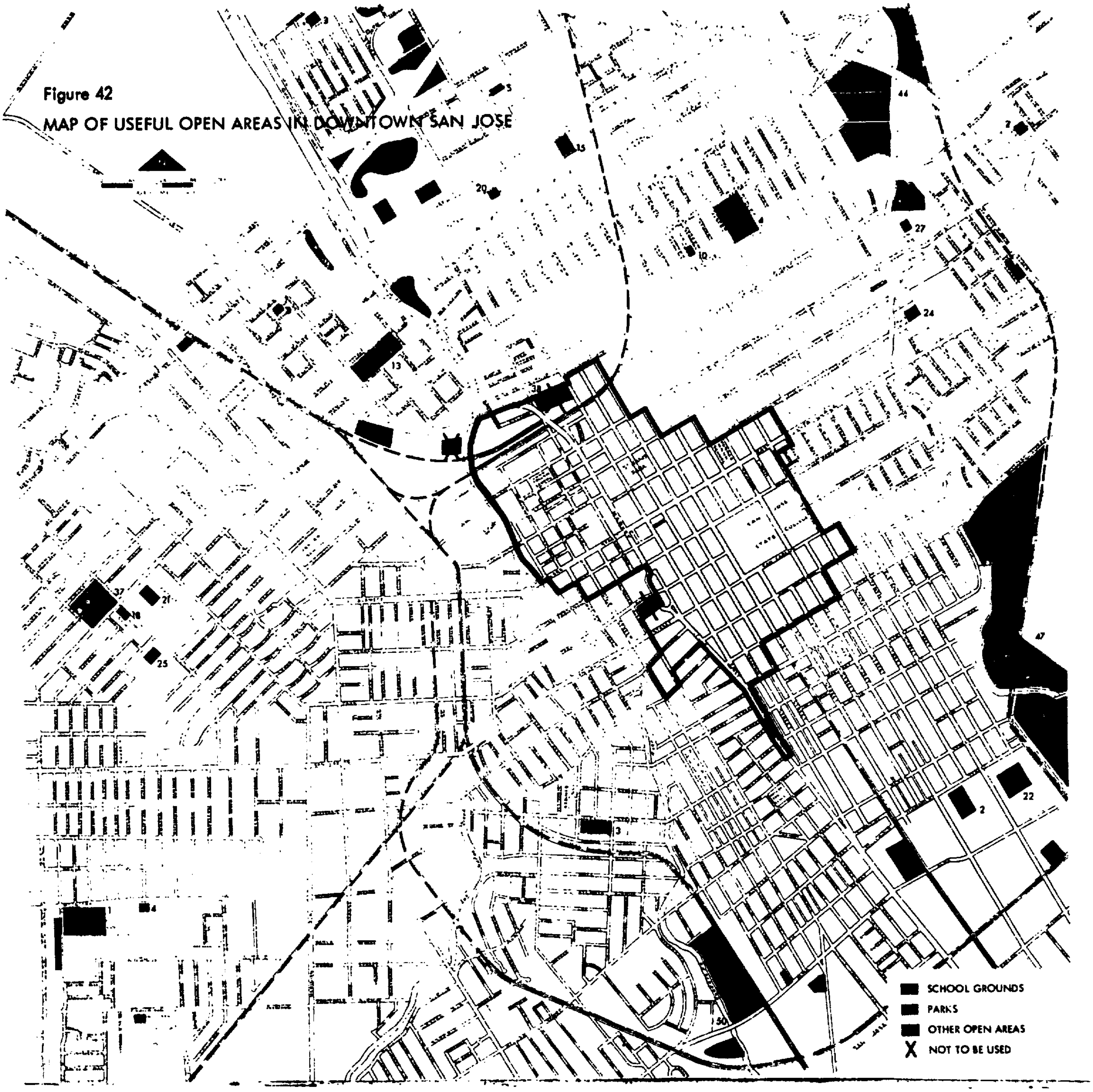
1. No school grounds were affected.

2. One small park (No. 38, "Ryland," capacity 500) was eliminated for being within the potential firestorm area.

3. Part of one field, outside the potential firestorm area but within 1/4 mile of its boundary, was degraded in value. It appears to be useful only as a transient safe area--i.e. an area which people can pass through safely, but in which they cannot stay.

Figure 42

MAP OF USEFUL OPEN AREAS IN DOWNTOWN SAN JOSE



POTENTIAL "AREAS OF NO FIRE ESCAPE" IN DOWNTOWN SAN JOSE (DIRECT EFFECTS)

Consider now the conditions of Attack No. 1 of the Five-City Study. There is no fallout present outside. The first weapons effects to be experienced in San Jose are from an airburst near Moffett Field. Downtown San Jose is thereby exposed to low level blast and it is assumed that a general community fire is initiated. We would like to know how the survivors and the developing fire downtown are likely to interact.

We have noted certain open areas as useful refuges from mass fire effects. And we have noted that the time available for movement to those open areas: (1) in the Heavier-than-Light-Residential Areas, may be limited to as little as 20 minutes; and (2) in the Light-Residential Areas (in the absence of fallout), may be unlimited in duration (assuming no further attacks or fallout occur). So the course of action for the downtown survivors—and there should be many of them—is to escape from mass fire effects by moving to useful open areas. If the open area is within the Heavier-than-Light-Residential Area, that movement must be completed in about 20 minutes. If the open area is within the Light-Residential Area, that movement must take people out of the Heavier-than-Light-Residential Area and into the Light-Residential Area (but not necessarily to the open area) in about 20 minutes.

To convert these temporal planning factors to distances we assume that survivors moving in built-up regions exposed to low-level blast can generally walk at about half speed—say 1-1/2 miles per hour. So in 20 minutes they could move something like 1/2 mile. If the Heavier-than-Light-Residential Area were no bigger than 1 mile in any direction, then all the survivors who originated there could walk out and into the surrounding Light-Residential Area within the 20 minutes specified. In that case no one would be trapped within the downtown area subject to overexposure to mass fire effects. This is very nearly the case for downtown San Jose—very nearly, but not quite.

If we start with the outer boundary of the Heavier-than-Light Residential Area (Figure 40), and then strike a line which is everywhere 1/2 mile within that outer boundary, we find a residual "area of no fire escape," as shown in Figure 43. Survivors initially within this area are not assured of escaping into Light-Residential Areas before they may be overcome by mass fire effects.

The "area of no fire escape" of Figure 43 is based entirely on escaping into the nearest Light-Residential Area and then proceeding within light-residential country to a useful open area. It is conceivable that there might be useful open area refuges within the Heavier-than-Light-Residential Area that were closer than the nearest Light-Residential Area. However, a survey of Figure 42 fails to reveal any satisfactory open area whose use would significantly modify the "area of no fire escape" shown.

> In planning direct-effects protection, one should strive to have neither shelter nor people (at the time of attack) within the "area of no fire escape" shown in Figure 43.

POPULATION OF DOWNTOWN SAN JOSE

The maps of Figures 44 and 45 (overleaf) show rough approximations of the distributions of population downtown during the nighttime and daytime respectively. These are based on 1960 Census Tract data. Distributions of people within Census Tracts have been estimated.

These figures also show the potential "area of no fire escape" from Figure 43. The approximate numbers of people who would be caught therein (if no movement occurred before attack) are 1900 at night, and 4100 in the daytime.

Figure 43

MAP OF POTENTIAL "AREA OF NO FIRE ESCAPE" IN SAN JOSE

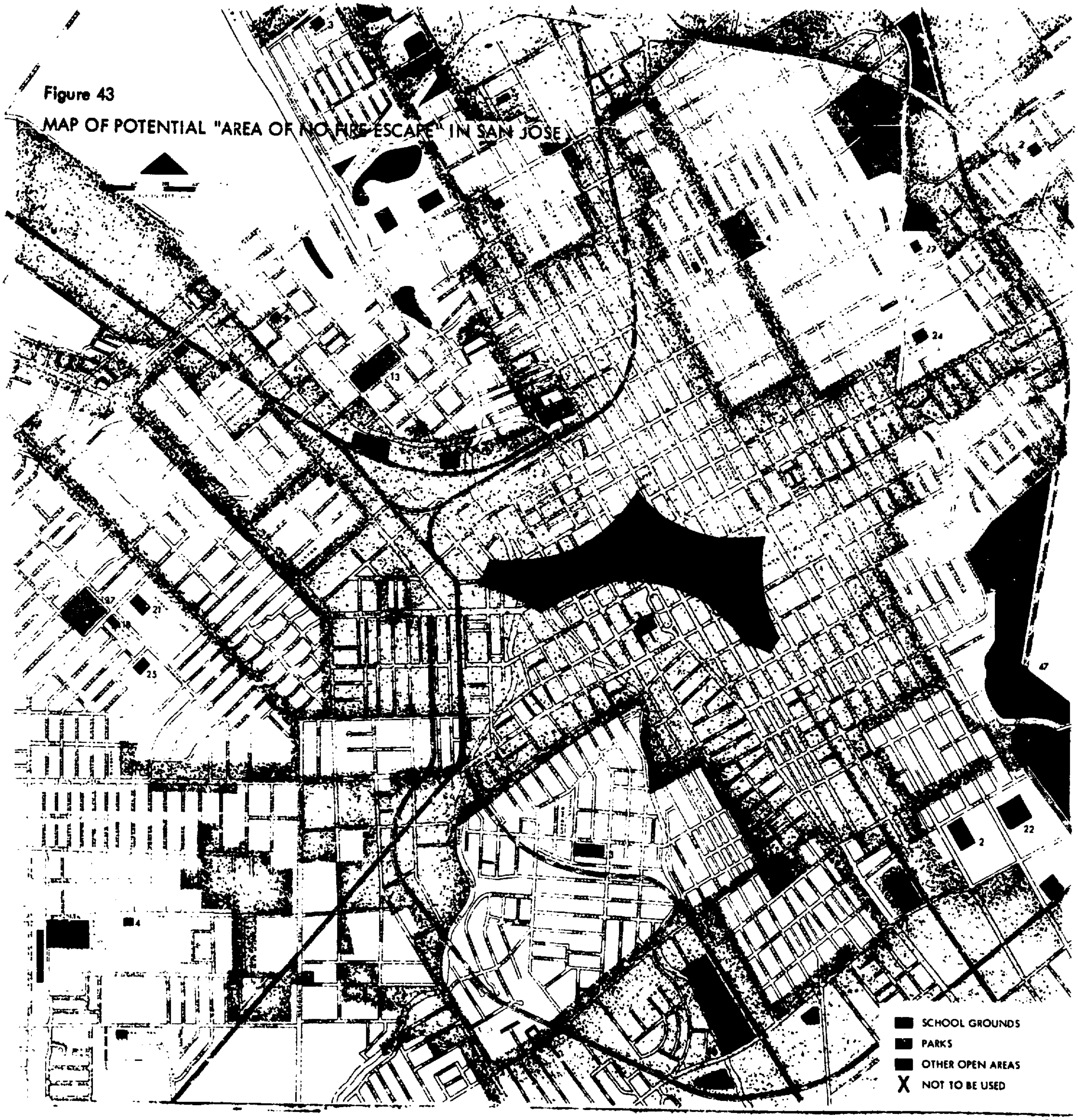


Figure 44

NIGHTTIME POPULATION DISTRIBUTION OF DOWNTOWN SAN JOSE (1960), AND CENSUS TRACTS

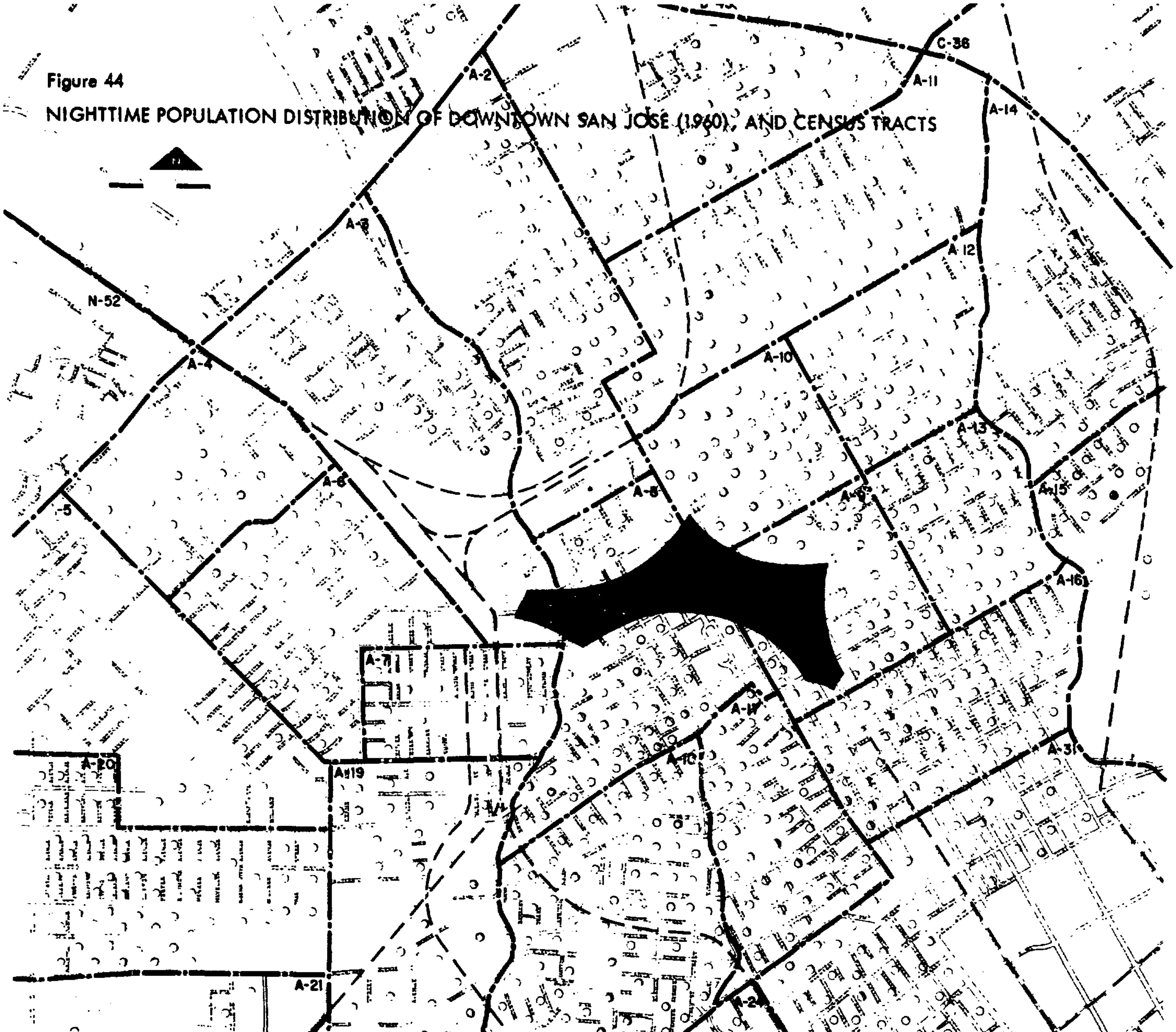
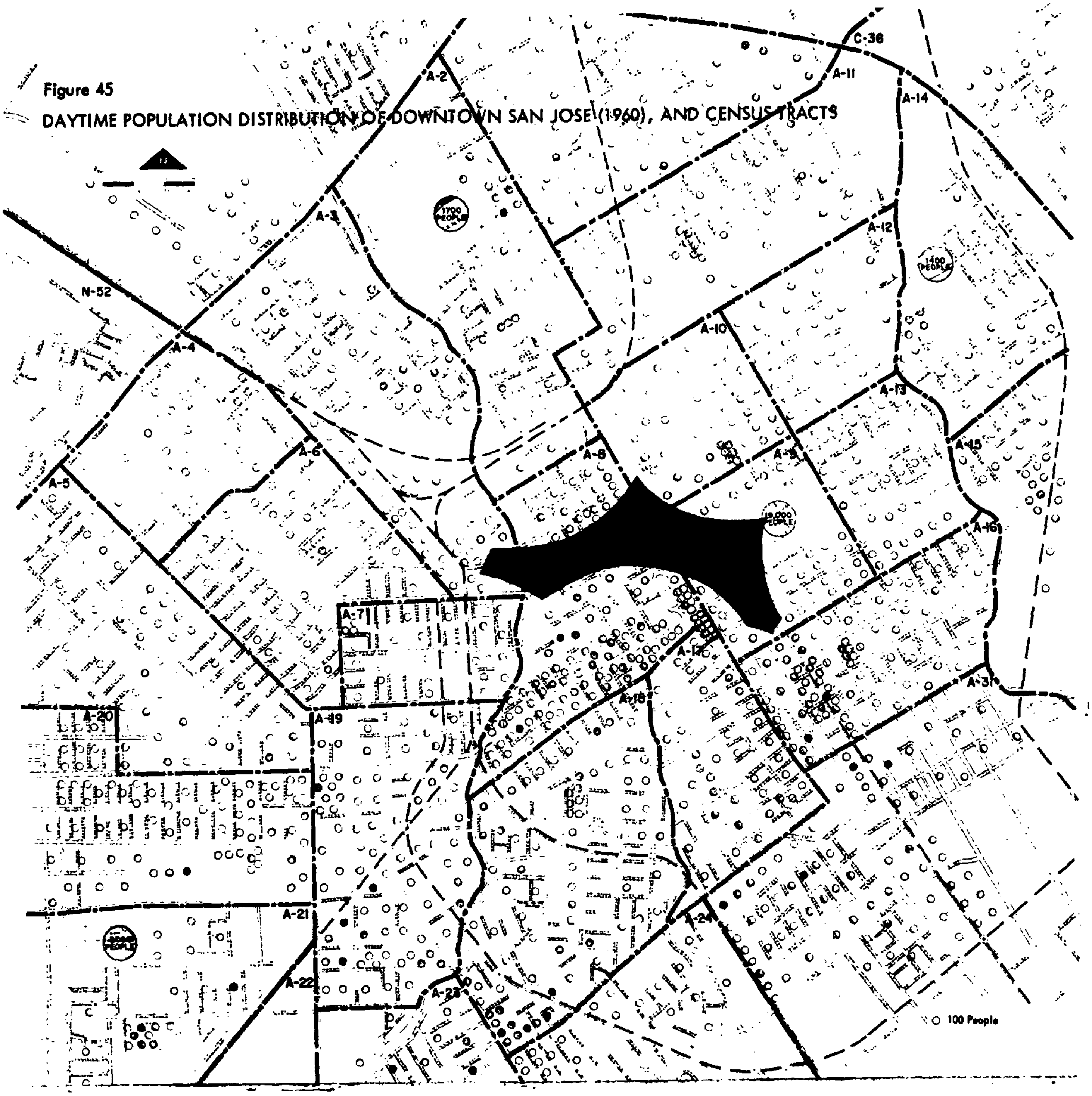


Figure 45

DAYTIME POPULATION DISTRIBUTION OF DOWNTOWN SAN JOSE (1960), AND CENSUS TRACTS



NFSS BASEMENT SHELTERS IN DOWNTOWN SAN JOSE (DIRECT EFFECTS)

The NFSS Basement Shelters in downtown San Jose are shown on the map of the facing page. Recall that these seem to be the only existing parts of buildings worth considering as shelter against direct effects; and they need to be upgraded considerably before their use can be recommended. And with low-cost upgrading their utility for direct-effects protection is probably limited to 2 and 5 psi (i.e. $\ll$ 10 psi). The possibility of a given basement being suitable for upgrading against mass fire and blast effects depends upon:

1. General location, and

2. Individual characteristics.

Basement shelters located within either the "potential fire storm area" or the "area of no fire escape" are unattractive for upgrading, almost regardless of their individual characteristics. Such shelters appear on the map within one or the other of the extra-hazardous areas shown.

Direct-Effects Capacities of Shelter Complexes Jeopardized by Potential Firestorm Area

Complex	As Is	Vent Added	Total
1	4,490	7,076	11,566
2	591	1,358	1,949
3	1,708	5,139	6,847
4	3,026	2,314	5,340
5	563	1,026	1,589
6	246	340	586
Total Loss	10,624	17,253	27,877

Sample inspections have been made of the principal basement shelters in San Jose to determine their suitability for upgrading. The results are given in Appendix A, and summarized at the top of the next column.

Direct-Effects Capacities of Additional Shelters Jeopardized by Own Internal Fire Hazard

Shelter	Complex	As Is	Vent Added	Total
147	8	300	750	1,050
175	24	2,756	0	2,756
Total Loss		3,056	750	3,806

* * * * *

We know of no significant Special Facilities which might be useful as shelter in downtown San Jose. The covered drainage facilities of San Jose which have possibilities for shelter are located elsewhere. There are no lakes, bays or oceans in downtown San Jose. The only other existing potential for direct-effects protection downtown seems to be in the creeks and rivers which can be seen on the map of the opposite page to cut through the center of things. In the downtown area these streams are within gullies of appreciable size and depth and--if they were provided with sufficient standing water for immersion--could conceivably contribute to the passive protection of the population there. They are presently rather overgrown in parts, enough to reduce their potential as a refuge from mass fire. For detailed characteristics, see the photographs of the streams in San Jose which appear in Appendix D.

* * * * *

The above completes the planning elements we have to present for the direct-effects protection of downtown San Jose.

* * * * *

The large scale map of the downtown area which has been employed here is also convenient to show the particular locations of many of the fallout shelters of possible use for fallout-only protection in San Jose (Hypothetical). So Figures 47 and 48 which follow show those details.

Figure 46

LOCATIONS OF NFSS BASEMENT SHELTERS DOWNTOWN

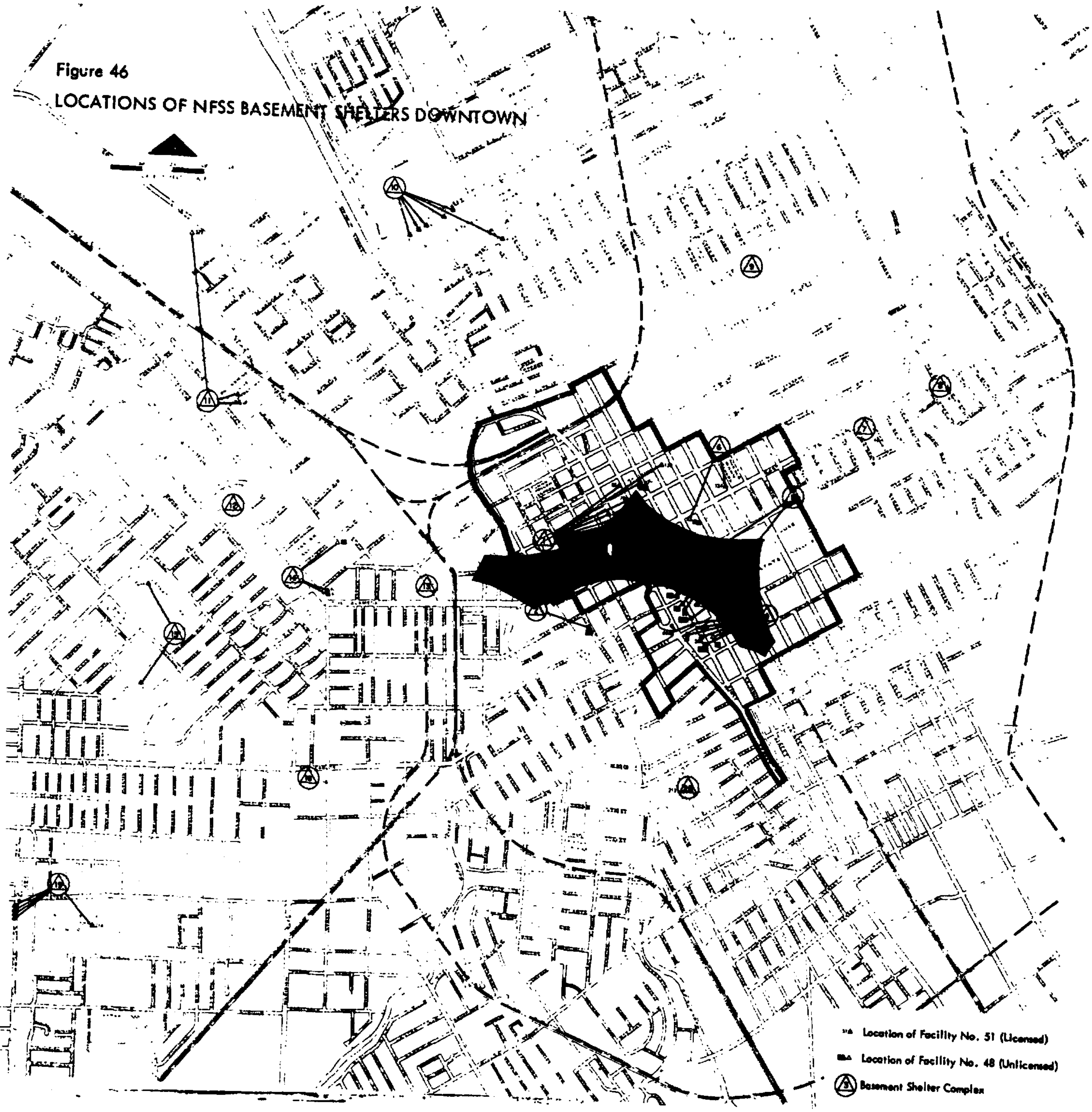


Figure 47

LOCATIONS OF NFSS CATEGORY I SPACES, ABOVE & BELOWGROUND (PF 20-40), DOWNTOWN, AS POSSIBLE PROTECTION FROM FALLOUT ONLY

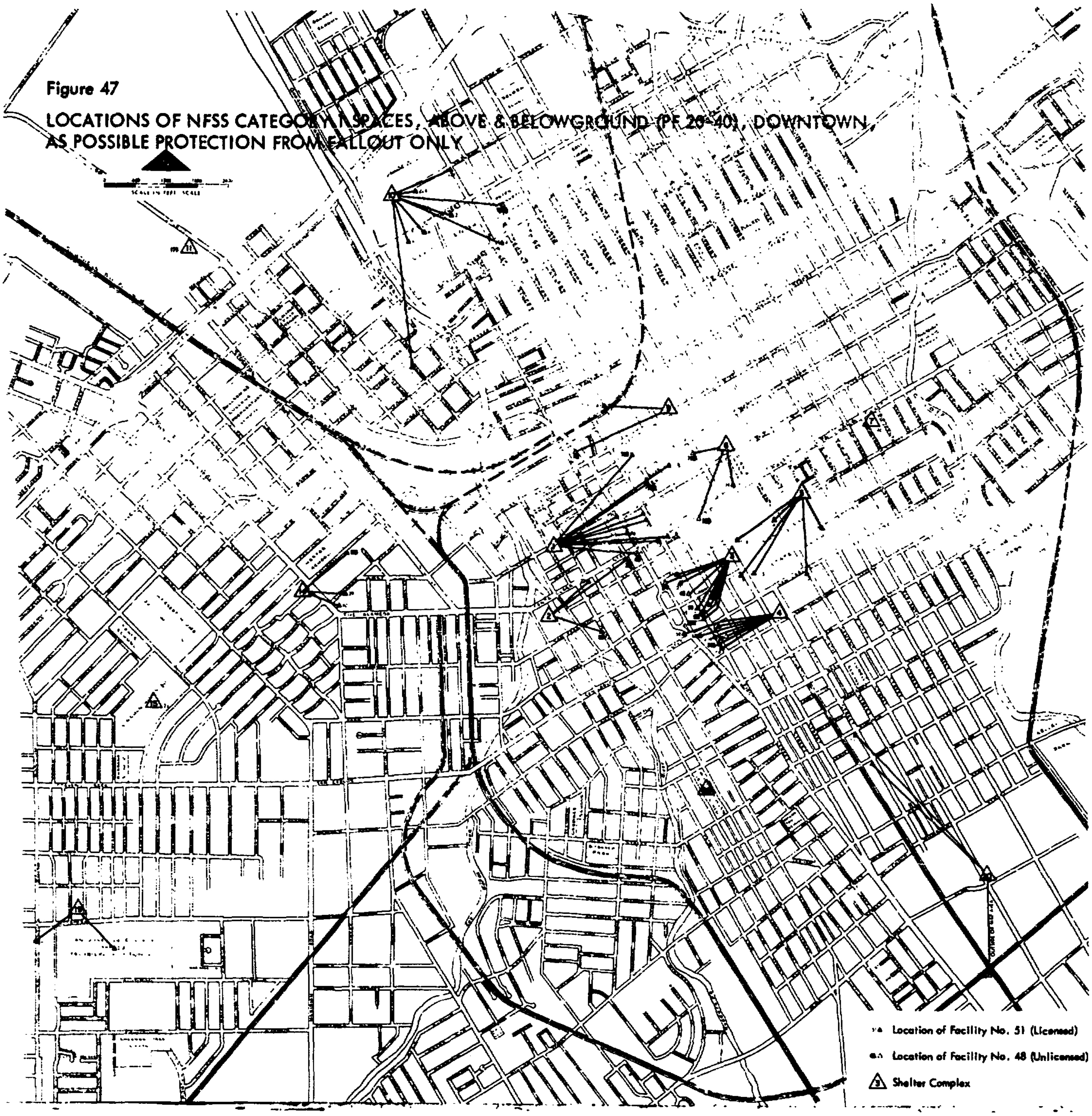
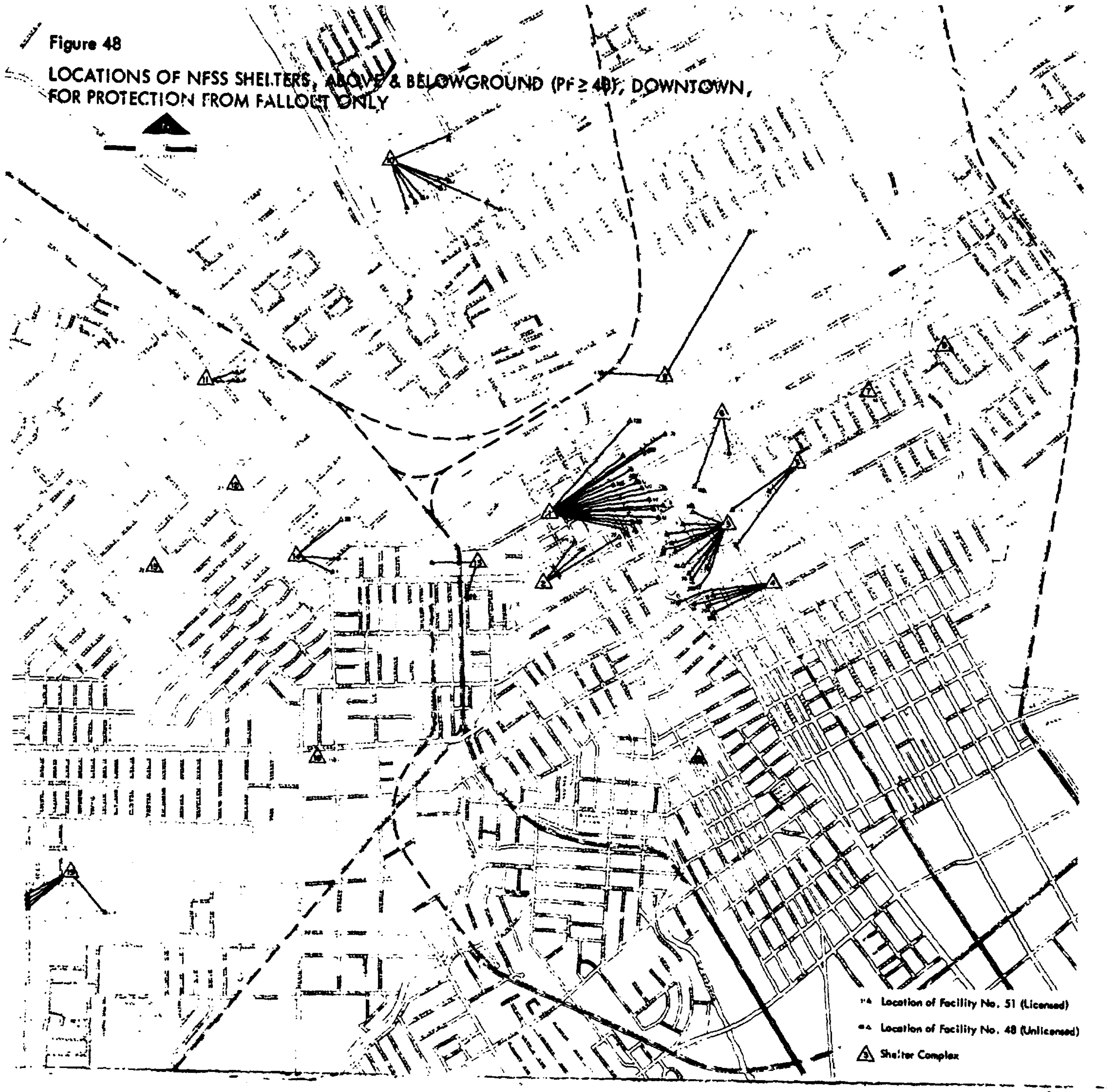


Figure 48

LOCATIONS OF NFSS SHELTERS, ABOVE & BELOWGROUND (PF ≥ 40), DOWNTOWN, FOR PROTECTION FROM FALLOUT ONLY



VI AREA-WIDE SHELTER SYSTEMS FOR SAN JOSE

If we have done our preparatory work properly, we should now be ready and able to take the preceding material and build appropriate plans for area-wide shelter systems for San Jose for direct effects and for fallout only. This is the final chapter....this is why we came....this is what we have been waiting for. In the pages which follow we show several systems of shelters and shielding against nuclear attack which should be of interest and value to the people of San Jose.

Before getting down to cases, let us remind the reader that we have already outlined on pages 40 and 42 the "basic planning procedures" for area-wide shelter systems. Those 9 steps have determined our planning of each of the shelter systems to be described in this chapter.

The general nature of the shelter systems to be detailed here was also indicated earlier on page 41 for San Jose (Direct Effects), and page 43 for San Jose (Fallout Only). San Jose (Direct Effects) necessitates protection against flash, blast, mass fire and fallout. San Jose (Fallout Only) requires solely protection from radioactive fallout. The shelter systems to be considered are the following:

Plan Ia--Direct-Effects Region--Strictly Status Quo without Water Shielding.

Plan Ib--Direct-Effects Region--Strictly Status Quo with Water Shielding.

Plan II--Direct Effects Region--Improved Status Quo plus New Almaden Mines.

Plan III--Direct Effects Region--Ideal Blast Protection (All New Shelters).

Plan A--Fallout-Only Region--Strictly Status Quo.

Plan B1--Fallout-Only Region--Improved Status Quo for Better Protection.

Plan B2--Fallout-Only Region--Improved Status Quo for Better Habitability.

Plan C--Fallout-Only Region--Complete Fallout Protection.

Other combinations and variations are, of course, conceivable. Those presented, however, are believed to be sufficient to show the general character of the principal alternatives.

There are included in a few of these plans certain particular measures for increased emergency-readiness, when those measures were necessary or desirable to get enough shelter or shielding spaces for the people involved. To keep the presentation reasonably simple, no specific reference is made in these plans to other measures for increased emergency-readiness which might also be helpful in this or other ways. The reader is reminded that the aim is to provide the best possible protection using whatever combination of permanent and temporary procedures can be usefully employed. In the total program for passive protection, full attention would be given to every aspect of increased emergency-readiness, as was previously suggested on pages 41 and 43, and 59 and 61.

PLAN Ia--DIRECT-EFFECTS REGION--STRICTLY STATUS QUO WITHOUT WATER SHIELDING

Plan Definition

Provide the best possible protection from flash/blast/mass fire/fallout for the people of San Jose using only the physical facilities which already exist in San Jose--nothing new is to be built, no improvements are to be obtained by modifications. Nominal capacities may be doubled if necessary. Since no new protection can be considered, no maximum acceptable time or distance to shelter can be specified; no minimum protection can be required. It is assumed that water shielding is impractical and should not be used.

If the foregoing does not provide enough shelter, then covered earth trenches will be constructed in selected large incombustible open areas in San Jose for those unprotected, as part of a program for increased emergency-readiness in response to a serious threat of nuclear attack.

This differs from PLAN Ib in not allowing water shielding. In PLAN Ib water shielding is assumed to be practical, and is used both for basic protection and for increased emergency-readiness.

Available Protective Resources

The only immediately usable asset is:

1. The Covered Drainage Facilities of San Jose.
   Shown on Figure 19. } These have a nominal total capacity of 34,500.
   Detailed in Table 3. } Their emergency capacity is twice this or 69,000.

   Since we are trying to protect some 300,000 people, we would do well to use the emergency capacity of 69,000--to make this limited protection cover as many people as possible.

The approximate relation between the population to be protected and this protective resource is shown on the facing map. Obviously this protection will inevitably be grossly inadequate.

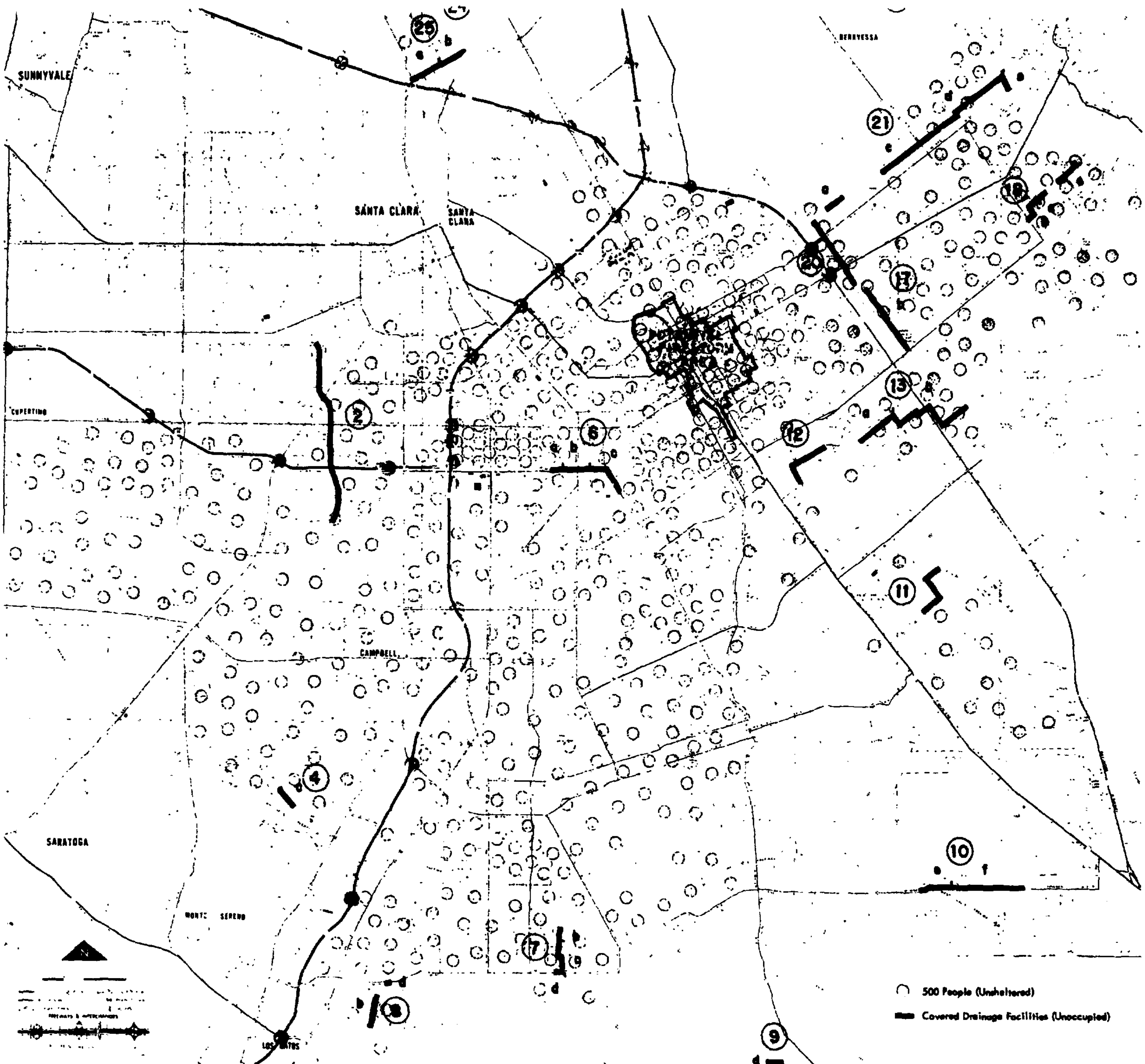
Increased Emergency-Readiness

Communities which do not provide their population with adequate shelter that is permanent can only build up their passive protection as a "last-minute" countermove to a perceived danger of enemy attack. For that purpose this report recommends the organized "crash" construction (according to existing carefully made plans) of covered trenches in certain large incombustible open areas within the community. The sites for these protective trenches are:

1. Selected Public School Grounds of San Jose.
   Shown on Figure 22.
   Detailed in Appendix E. } These have a nominal total capacity of 1,456,000.

2. Selected Public Parks (and Golf Courses) of San Jose.
   Shown on Figure 23.
   Detailed in Appendix F. } These have a nominal total capacity of 842,000.

The parts of the public school grounds and parks acceptable for passive protection have a combined nominal capacity of about 2,298,000 persons--many times greater than the 300,000 or so that we are trying to protect.


SUNNYVALE
SANTA CLARA
SANTA CLARA
BERRYESSA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
500 People (Unsheltered)
Covered Drainage Facilities (Unoccupied)

PLAN Ia--DIRECT-EFFECTS REGION--STRICTLY STATUS QUO WITHOUT WATER SHIELDING

SHELTER PROVIDED BY COVERED DRAINAGE FACILITIES ONLY (OCCUPANCY DOUBLED)

__Comments__

The facing map indicates roughly who is and who is not protected when just the Covered Drainage Facilities are used as shelter, at twice their normal capacity. The Characteristic Curves for this protective system are given below; all values are commendable: time to shelter,* protection and PF. There is nothing wrong with the protection of these covered drains. They are deficient only in living conditions and quantity. The basic difficulty with this approach is there just aren't enough large covered drainage facilities (or equivalent) in San Jose for the population.

The bulk of the people of San Jose will be protected by this PLAN only after the associated program for increased emergency-readiness has put covered trenches for most of the inhabitants in the earth of suitable public school grounds and parks. This major (but short-term) increase in protection is shown on the next page.

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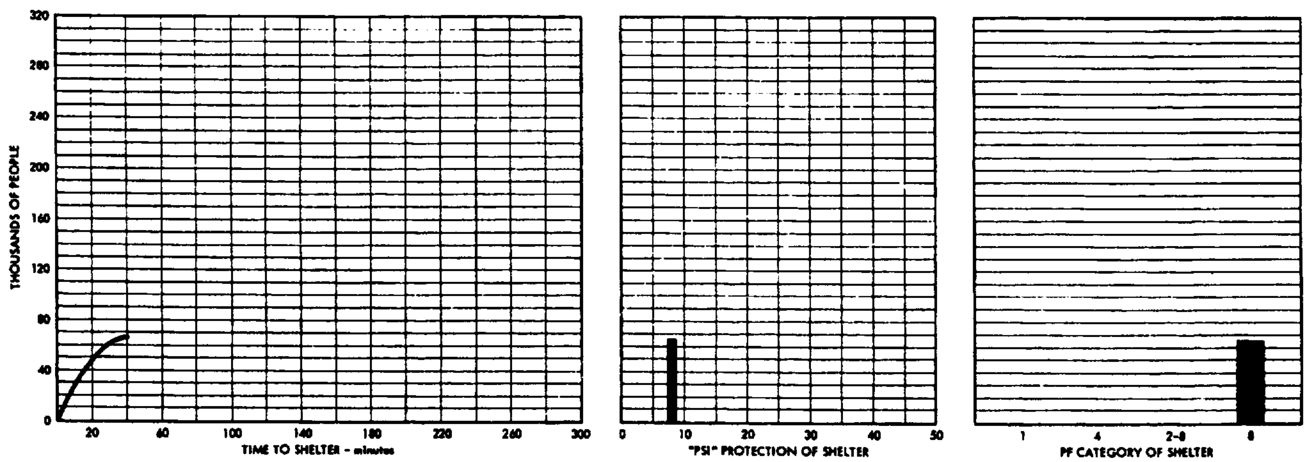
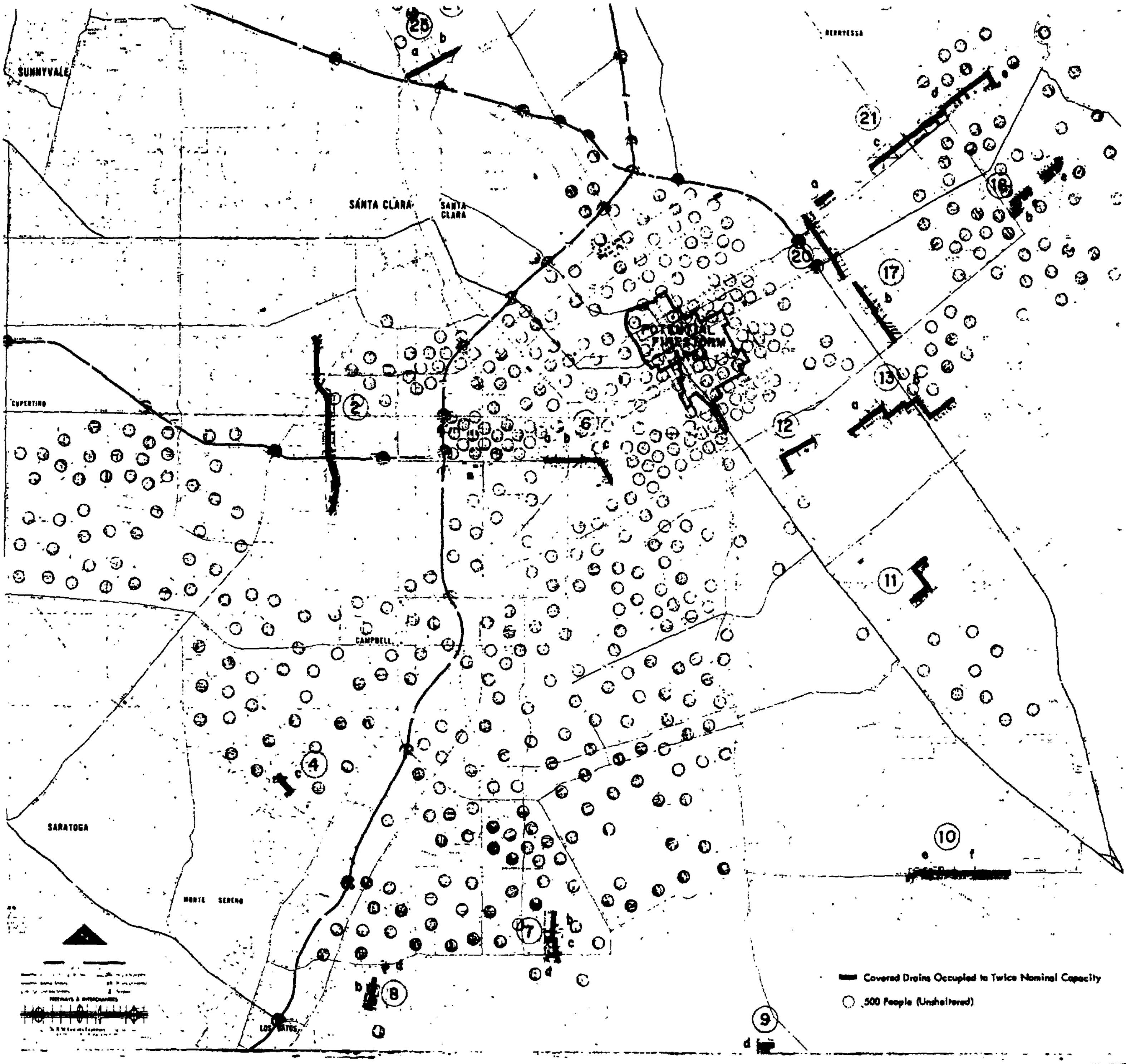
* It is assumed that people get into these buried culverts and pipes through manholes along their length, so that loading is not confined to just the open ends.

__Characteristic Curves__




SUNNYVALE
SANTA CLARA
SANTA CLARA
CUPERTINO
BERRYESSA
POTENTIAL FIRESTORM
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
Covered Drains Occupied to Twice Nominal Capacity
500 People (Unsheltered)

PLAN Ia--DIRECT-EFFECTS REGION--STRICTLY STATUS QUO WITH [illegible] SHIELDING

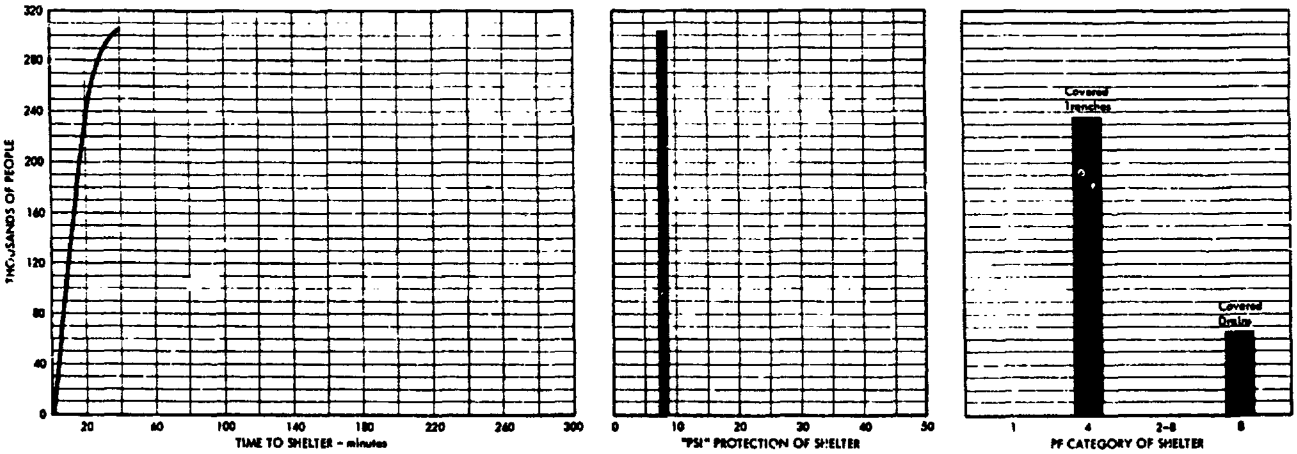
SHELTER PROVIDED BY COVERED TRENCHES IN OPEN AREAS; ALSO COVERED DRAINAGE FACILITIES (OCCUPANCY DOUBLED)

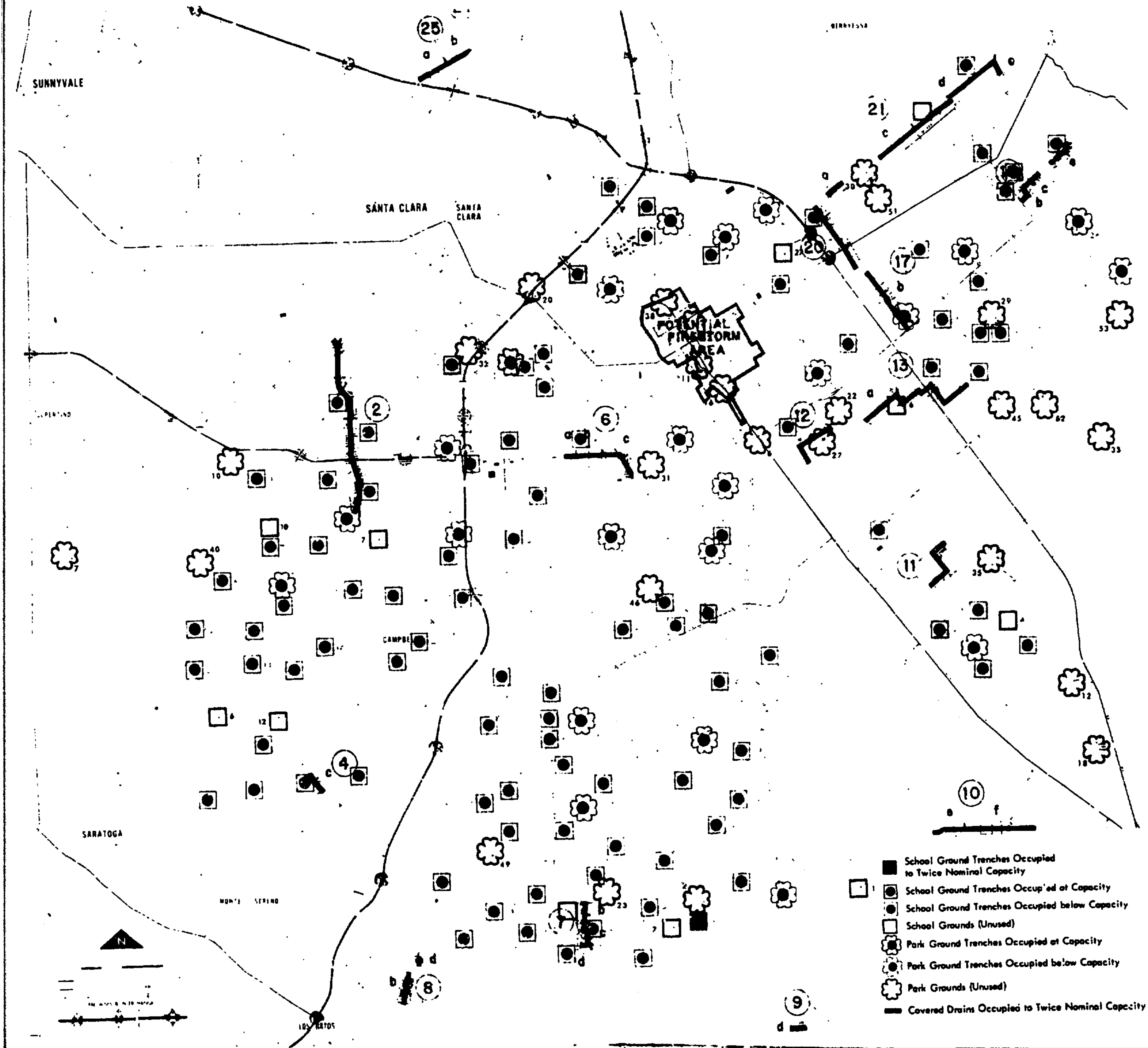
Comments

The facing map shows everyone in San Jose protected by (1) emergent covered trenches in public school grounds and parks and (2) existing covered drainage facilities (nominal capacity doubled). The school grounds, parks, and drainage facilities utilized for shelter/shielding are identified by symbol. The capacities, total loading, and rates of loading of the school grounds and parks are given in Table 8 which follows. Similar data for the covered drainage facilities appeared on the previous page. The Characteristic Curves appear below, and look good. This PLAN provides appreciable protection at low cost--primarily the cost of digging, shoring and covering the trenches.

The disadvantages of PLAN Ia do not show on the map or in the Characteristic Curves. They are basically twofold: (1) living conditions are mean, and (2) the protection depending on trenches (80% of the total) may or may not be available when needed. Emergent trenching is expected to be a positive reaction to a deteriorating international situation. It produces reasonably good protection if completed in time. But there is always a serious risk that such last minute preparations will not be done before they are needed. And if they are prepared ahead of the need there is always a chance that they will crumble away to works of little value before the attack actually occurs. Raw earth trenches are one-shot, impermanent protection, practically impossible to maintain in usable form for long periods of time. The living conditions in trenches could scarcely be worse, and although such excavations have served usefully to preserve the lives of countless humans in the past, they tend to be cold and wet and grimy.

Characteristic Curves





SUNNYVALE
SANTA CLARA
POTENTIAL FIRESTORM AREA
CAMPBELL
SARATOGA
LOS GATOS
School Ground Trenches Occupied to Twice Nominal Capacity
School Ground Trenches Occupied at Capacity
School Ground Trenches Occupied below Capacity
School Grounds (Unused)
Park Ground Trenches Occupied at Capacity
Park Ground Trenches Occupied below Capacity
Park Grounds (Unused)
Covered Drains Occupied to Twice Nominal Capacity

Table 8

THE USE OF PUBLIC SCHOOL GROUNDS AND PARKS FOR COVERED TRENCHES FOR INCREASED EMERGENCY-READINESS IN PLAN Ia

COLLEGIATE FIELDS

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	56,000	1,875	2,250	0	0	4,125
2	132,400	0	1,125	1,375	1,000	3,500
	Total	1,875	3,375	1,375	1,000	7,625

CAMPBELL ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	23,000	750	0	-	-	750
2	2,600	1,000	500	-	-	1,500
3	3,200	500	0	-	-	500
4	5,000	750	800	-	-	1,550
5	7,000	0	1,000	-	-	1,000
6	6,600	1,000	-	-	-	1,000
7	12,900	1,000	-	-	-	1,000
8	10,500	1,250	1,000	-	-	2,250
9	7,150	500	500	1,000	-	2,000
10	11,000	500	500	-	-	1,000
11	3,680	500	500	-	-	1,000
12	9,520	1,000	500	-	-	1,500
13	2,000	0	500	-	-	500
14	8,000	1,000	750	-	-	1,750
15	7,000	250	1,250	-	-	1,500
	Total	10,000	7,800	1,000	0	18,800

SAN JOSE UNIFIED

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	1,260	0	-	-	-	0
2	5,360	-	-	250	250	500
3	8,250	1,250	250	0	1,000	2,500
4	9,520	1,500	2,500	500	-	4,500
5	1,280	1,000	0	375	0	1,375
6	7,430	1,000	1,750	1,000	0	3,750
7	4,380	250	875	0	-	1,175
8	1,380	1,125	125	0	-	1,250
9	2,410	2,500	0	-	-	2,500
10	1,845	2,000	0	-	-	2,000
11	9,380	0	-	-	-	0
12	15,150	1,000	0	-	-	1,000
13	1,660	1,500	250	0	-	1,750
14	7,000	1,000	0	500	-	1,500

SAN JOSE UNIFIED (Continued)

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
15	1,920	1,000	625	0	-	1,625
16	7,557	1,625	500	0	0	2,125
17	-	-	-	-	-	-
18	2,250	2,000	0	0		2,000
19	5,645	1,000	0	125		1,125
20	10,190	1,500	3,250	0		3,750
21	21,600	1,125	1,000	1,000		3,125
22	58,000	3,000	1,875	375		5,250
23	9,200	375	1,625	375		2,375
24	10,700	1,750	375	0		2,125
25	29,600	1,000	2,500	0	250	3,750
26	68,000	375	1,125	0		1,500
27	17,500	0	0	0		0
	Total	28,875	18,525	4,500	1,500	53,400

CAMPBELL UNION HIGH SCHOOL

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	66,000	500	0	-	-	500
2	65,000	0	250	-	-	250
3	48,000	2,000	500	500	-	3,000
4	24,144	1,000	0	-	-	1,000
5	55,500	0	-	-	-	0
6	22,500	2,000	250	-	-	2,250
	Total	5,500	1,000	500	0	7,000

MORELAND ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	0	0	0	-	-	0
2	9,100	500	500	-	-	1,000
3	4,500	1,000	500	-	-	1,500
4	9,000	0	2,000	-	-	2,000
5	19,400	700	0	-	-	700
6	6,200	1,500	750	0	-	2,250
7	880	0	0	-	-	0
8	2,000	1,250	0	-	-	1,250
9	4,000	400	0	-	-	400
10	3,800	0	0	-	-	0
11	24,000	1,000	0	-	-	1,000
12	5,700	600	500	-	-	1,100

TABLE 8 (Continued)

MORELAND ELEMENTARY (Continued)

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
13	4,800	600	750	-	-	1,350
14	[illegible],800	800	0	-	-	800
15	-	-	-	-	-	-
16	6,050	500	50	-	-	500
	Total	8,850	5,050	0	0	13,900

CAMBRIAN ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	3,140	1,250	1,300	-	-	2,250
2	11,950	1,200	500	-	-	1,700
3	21,600	250	0	-	-	250
4	3,760	750	0	-	-	750
5	5,600	750	500	-	-	1,250
6	3,840	1,000	2,250	-	-	3,250
7	3,840	1,250	1,250	-	-	2,500
8	4,150	1,000	1,000	1,000	-	3,000
	Total	7,450	6,800	1,000	0	15,250

UNION ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	5,068	1,250	2,000	-	-	3,250
2	5,040	1,600	1,000	-	-	2,600
3	8,840	2,300	1,500	-	-	3,800
4	11,200	750	500	-	-	1,250
5	18,000	500	0	-	-	500
6	10,600	1,000	0	-	-	1,000
7	45,200	0	0	-	-	0
8	280	500	0	-	-	500
9	12,600	500	500	-	-	1,000
10	13,100	250	0	-	-	250
11	3,000	750	0	-	-	750
12	9,400	1,250	0	-	-	1,250
13	7,200	1,500	600	1,500	2,000	5,600
14	23,200	600	0	-	-	600
15	9,740	700	200	-	-	900
16	3,370	800	800	-	-	1,600
	Total	14,250	7,100	1,500	2,000	24,850

ALUM ROCK UNION HIGH SCHOOL

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	62,500	1,500	500	-	-	2,000
2	42,500	700	1,250	-	-	1,950

ALUM ROCK ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	13,500	1,250	1,250	-	-	2,500
2	3,600	1,250	2,500	-	-	3,750
3	2,750	1,250	0	-	-	1,250
4	37,000	1,000	0	-	-	1,000
5	10,600	750	1,000	-	-	1,750
6	11,000	800	500	-	-	1,300
7	1,500	1,500	0	-	-	1,500
8	32,000	750	0	-	-	750
9	6,000	1,000	3,000	-	-	4,000
10	27,000	0	500	-	-	500
11	9,000	0	0	-	-	0
	Total	11,750	10,500	0	0	22,250

FRANKLIN McKINLEY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	7,210	2,000	0	-		2,000
2	1,260	250	500	500	-	1,250
3	6,700	0	0	1,000	-	1,000
4	16,000	0	0	0	-	0
5	3,920	500	1,000	500	-	2,000
6	3,350	0	0	0	-	0
7	4,050	1,000	0	0	-	1,000
8	-	-	-	-	-	-
9	16,600	200	500	-	-	700
	Total	3,950	2,000	2,000		7,950

PARKS

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	-	-	-	-	-	-
2	8,500	0	-	-	-	0
3	7,800	1,500	500	4,500	0	6,500
4	19,000	750	2,000	2,000	3,500	8,000
5	3,200	250	0	-	-	250

TABLE 8 (Continued)

PARKS (Continued) NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
6	0	-	-	-	-	0
7	8,700	-	-	-	-	0
8	10,000	-	-	-	-	0
9	10,000	1,750	0	-	-	1,750
10	8,400	-	-	-	-	0
11	0	-	-	-	-	0
12	0	-	-	-	-	0
13	7,600	1,500	3,625	1,500	1,250	7,375
14	6,100	1,000	0	-	-	1,000
15	500	0	500	-	-	500
16	0	-	-	-	-	0
17	-	500	-	-	-	500
18	-	-	-	-	-	0
19	4,500	500	500	-	-	1,000
20	0	-	-	-	-	0
21	6,100	500	0	-	-	500
22	44,000	-	-	-	-	-
23	-	-	-	-	-	-
24	-	500	-	-	-	500
25	-	2,000	1,500	1,000	-	4,500
26	-	1,500	1,500	-	-	3,000
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	0	-	-	-	0
31	0	-	-	-	-	-
32	0	-	-	-	-	-
33	-	-	-	-	-	-
34	-	1,500	0	-	-	1,500
35	-	-	-	-	-	-
36	8,800	1,750	2,500	500	-	4,750
37	3,800	250	875	3,000	-	4,150
38	-	-	-	-	-	-
39	6,700	0	3,000	0	-	3,000
40	500	-	-	-	-	0
41	-	250	-	-	-	250
42	0	-	-	-	-	0
43	4,700	0	200	-	-	200
44	25,400	750	0	-	-	750
45	5,800	-	-	-	-	0
46	0	0	-	-	-	0
47	22,000	2,250	3,000	1,500	-	6,750
48	7,400	2,125	0	625	0	2,750
49	378,000	0	-	-	-	0
50	24,000	500	2,000	3,500	-	6,000
	Total	22,125	21,700	17,625	4,750	66,200

Justification for Doubling Nominal Capacities in an Emergency

In many of these area-wide shelter systems, the total nominal capacity of the designated protective facilities is much less than the candidate population. In such cases, to get as much protection as possible from the very limited resources, we put as many people as we can into the protective facilities that are available. In general, for San Jose, we are willing to double the nominal capacity in emergencies where no other suitable protection can be found.*

Our justification for this action is twofold: (1) our 1965 study of this very problem concluded that shelters in places like San Jose could have their nominal occupancies doubled in an emergency--but doubling was about the limit of feasible compaction--and (2) the "Community Shelter Program" proposed by San Jose officials in 1962 called for doubling the nominal occupancy in the early phases when there were not yet enough newly built shelters. The first substantiates the technical feasibility of "doubling;" the second shows the operational willingness to accept "doubling."

Justification for the Time-Distance Relationship Used in Moving to Shelter

Thirty minutes is used here and elsewhere as a planning factor for the maximum acceptable time for moving to fallout shelter. For that movement, carried out in advance of any serious damage to the community, it is assumed that walking at 3 miles per hour is feasible and practical. Allowing 10 minutes to get ready to move, and moving people about 1 mile during the remaining 20 minutes, gets us 1 mile away by the time 30 minutes has elapsed after warning to take shelter is first given.

Estimates of Protection Quality

The nominal values of protection used in this chapter for the Characteristic Curves are:

PROTECTIVE FACILITY	PSI WHERE PROTECTION FAILS	PROTECTION FACTOR CATEGORY
Covered Drainage	8	8
Covered Trenches	8	4
Swimming Pools	2	1
Creeks and Rivers	2	1
New Almaden Mines	8?	8
Upgraded NFSS Basements	8	1-8
NFSS Shelters, As Is	2	1-8
Home Basements	2	1
New Blast Shelters	50	8
New Fallout Shelters	≥ 5	≥ 4

* See footnote, page 40.

PLAN Ib--DIRECT-EFFECTS REGION--STRICTLY STATUS QUO WITH WATER SHIELDING

Plan Definition

Provide the best possible protection from flash/blast/mass fire/fallout for the people of San Jose using only the physical facilities which already exist in San Jose--nothing new is to be built, no improvements are to be obtained by modifications. Nominal capacities may be doubled if necessary. Since no new protection can be considered, no maximum acceptable time or distance to shelter can be specified; no minimum protection can be required. It is assumed that water shielding is practical and should be used as needed.

If the foregoing does not provide enough shelter/shielding, then the water level in the creeks and rivers of San Jose will be raised (if not already done) as required for good water shielding of those previously unprotected, as part of a program for increased emergency-readiness in response to a serious threat of nuclear attack.

Available Protective Resources

1. The Covered Drainage Facilities of San Jose.
   Shown on Figure 19. } These have a nominal total capacity of 34,500.
   Detailed in Table 3. } Their emergency capacity is twice this or 69,000.

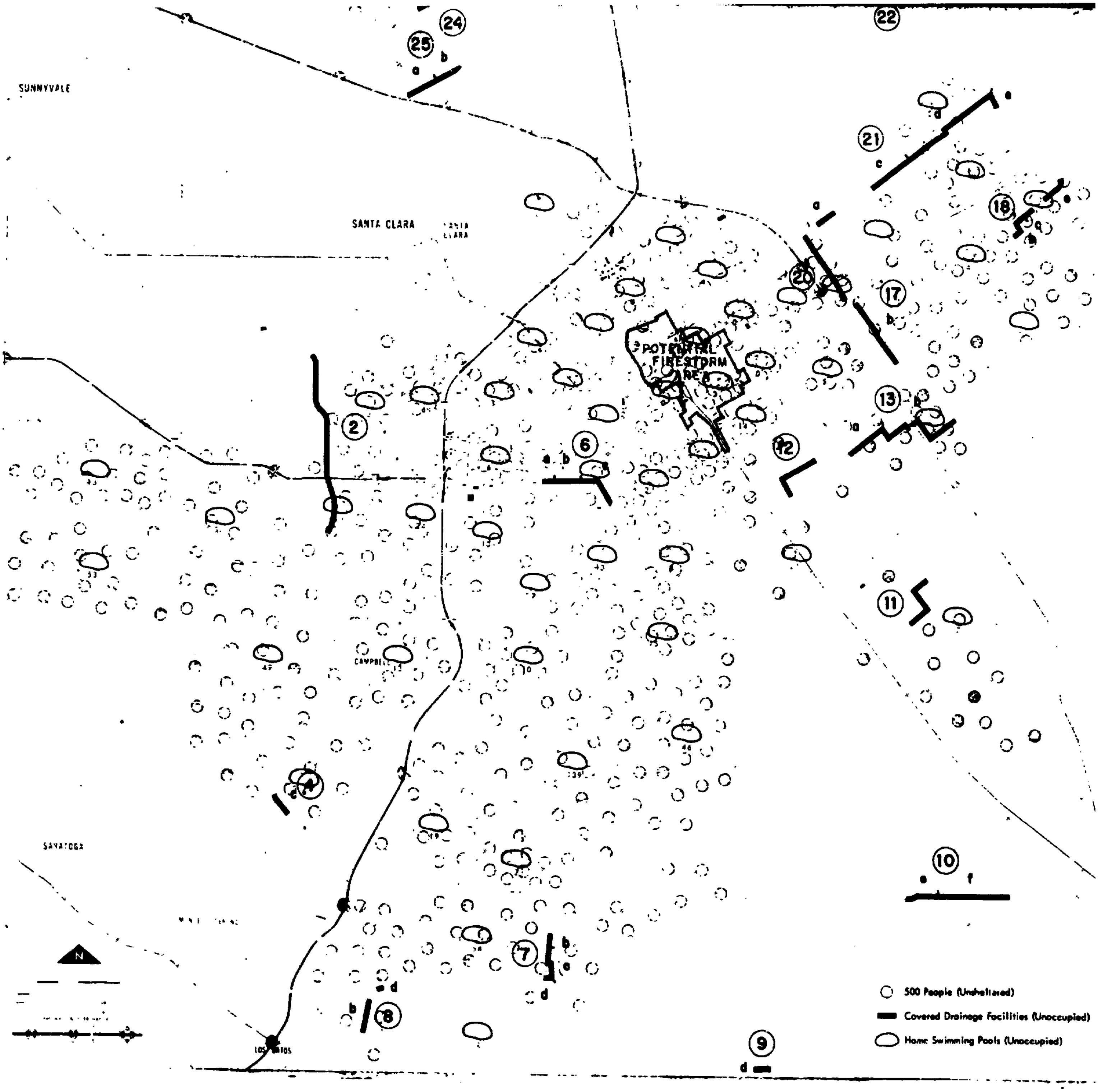
2. The Home Swimming Pools in San Jose.
   Shown on Figure 30. } These have a nominal total capacity of 46,000.
   Detailed in Appendix G. } Their emergency capacity is twice this or 92,000.

Since we have some 300,000 people to protect, it seems advisable to provide as much protection as possible with these limited assets. Thus nominal capacities should be doubled where feasible. This gives a combined total emergency capacity of about 161,000. Approximate relations between the population to be protected and these protective resources are shown on the facing map. While these resources are bound to protect more people than PLAN Ia (where water shielding was assumed to be impractical), they cannot suffice for the population of San Jose.

Increased Emergency-Readiness

It may be possible as a protective reaction to a serious threat of nuclear attack to augment the permanent protection specified above. This could be done, as in PLAN Ia, by building covered trenches in suitable open areas for those still unprotected. However, that approach would be so similar to PLAN Ia that nothing new would be learned. (Nevertheless, this is an acceptable procedure, and PLAN Ia results show the approximate consequences.) We could also make more water shielding available as part of a program for increased emergency-readiness. One way would be to raise the standing water level in the creeks and rivers which traverse San Jose. By constructing small cross-channel dams it should be possible to have at least 18" of water in the streambeds at all times. This is a new and different approach and will be used here to supplement that of Covered Drains and Swimming Pools. Assuming a sufficient supply of water in the upstream reservoirs, this raising of the water level in the streams should be much cheaper than the massive construction of ditches in open areas. (No determination has been made here of reservoir adequacy, or the times required for filling the streams to the new desired levels.) Of course combinations of ditching and water-level raising could also be used.

The creeks and rivers which could be prepared to provide water shielding are shown in Figure 21. Further descriptions are in Appendix D. Since the entire population of San Jose can be readily accommodated within these streambeds, their use for passive protection by immersion entails no significant concern for capacity.


SUNNYVALE
SANTA CLARA
POTENTIAL FIRESTORM AREA
CAMPBELL
SARATOGA
LOS GATOS
N
500 People (Unsheltered)
Covered Drainage Facilities (Unoccupied)
Home Swimming Pools (Unoccupied)

SHELTER PROVIDED BY COVERED DRAINAGE FACILITIES AND HOME SWIMMING POOLS (OCCUPANCY DOUBLED IN BOTH)

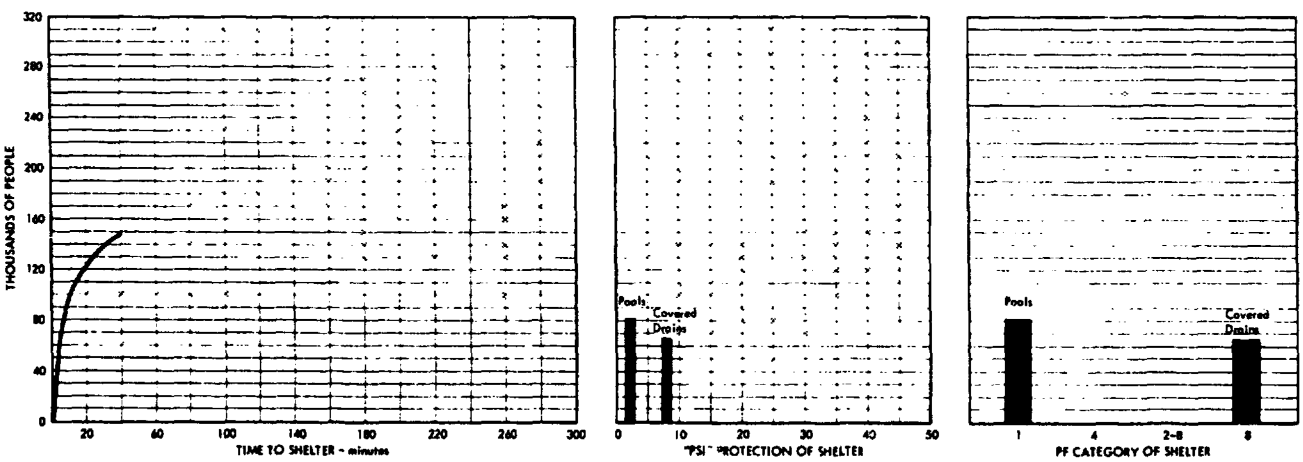
Comments

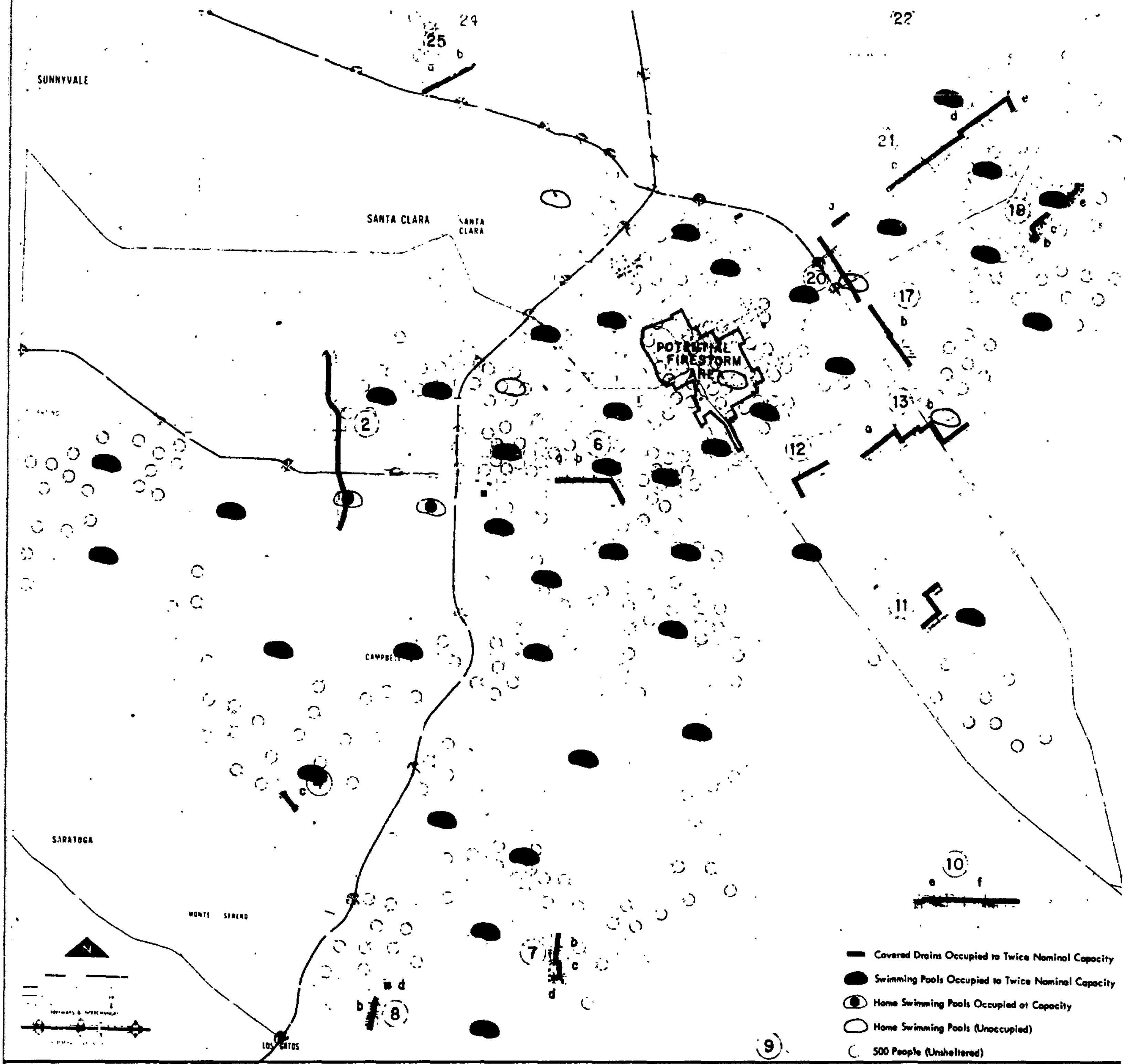
The facing map shows the portion of the population of San Jose which can be sheltered in Covered Drainage Facilities and Home Swimming Pools--immersion being necessary with the latter. Many people remain unprotected in spite of the emergency occupancy of twice nominal capacity throughout. Characteristic Curves for this shelter system are given below. The time-to-shelter curve looks good, demonstrating that these protective facilities are well situated relative to the population. The addition of the Swimming Pools to the Covered Drainage allows many more people to get some kind of permanent Universal Protection, although it is rather low grade. (Pool protection may actually be better than shown. Since we don't really know what it is, we have tried to set it low so that more is not promised than can be delivered.) Living conditions would be terrible.

These permanent facilities will have to be supplemented with other protection on a large scale before the entire population of San Jose can be sheltered. This is done in PLAN Ib by raising the water level in the creeks and rivers thereby making water shielding by whole body immersion possible anywhere along their courses. The results are displayed on the next page.

Standing water is unique among gamma-ray shielding materials in requiring no time for digging a hole, or piling up large masses. By immersing himself in water one makes an "instant hole." For occupied regions unprepared for civil defense and having appreciable standing water, there may be a worthwhile potential in water shielding. Short-term water shielding is known to be practical; satisfactory procedures for long-term water shielding need to be developed, since protracted immersion presently causes very serious physiological difficulties.

Characteristic Curves





SUNNYVALE
SANTA CLARA
SANTA CLARA
POTENTIAL FIRESTORM AREA
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
24
25
22
21
18
20
17
13
12
2
6
11
10
7
8
9
Covered Drains Occupied to Twice Nominal Capacity
Swimming Pools Occupied to Twice Nominal Capacity
Home Swimming Pools Occupied at Capacity
Home Swimming Pools (Unoccupied)
500 People (Unsheltered)

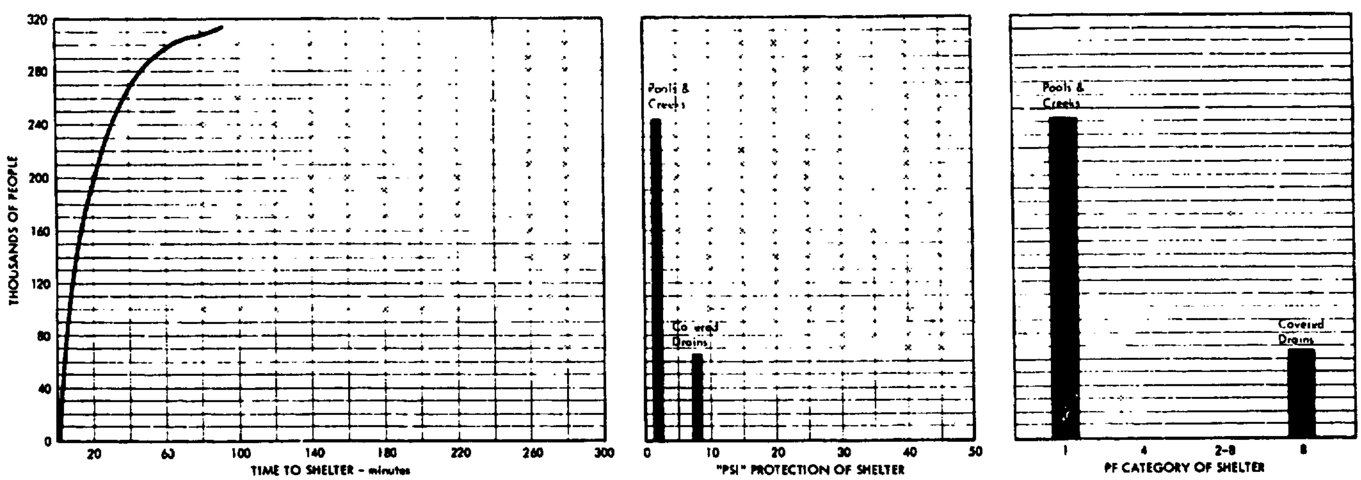
WATER SHIELDING IN CREEKS & RIVERS & SWIMMING POOLS; SHELTER IN COVERED DRAINS (DOUBLE OCCUPANCY IN POOLS/DRAINS)

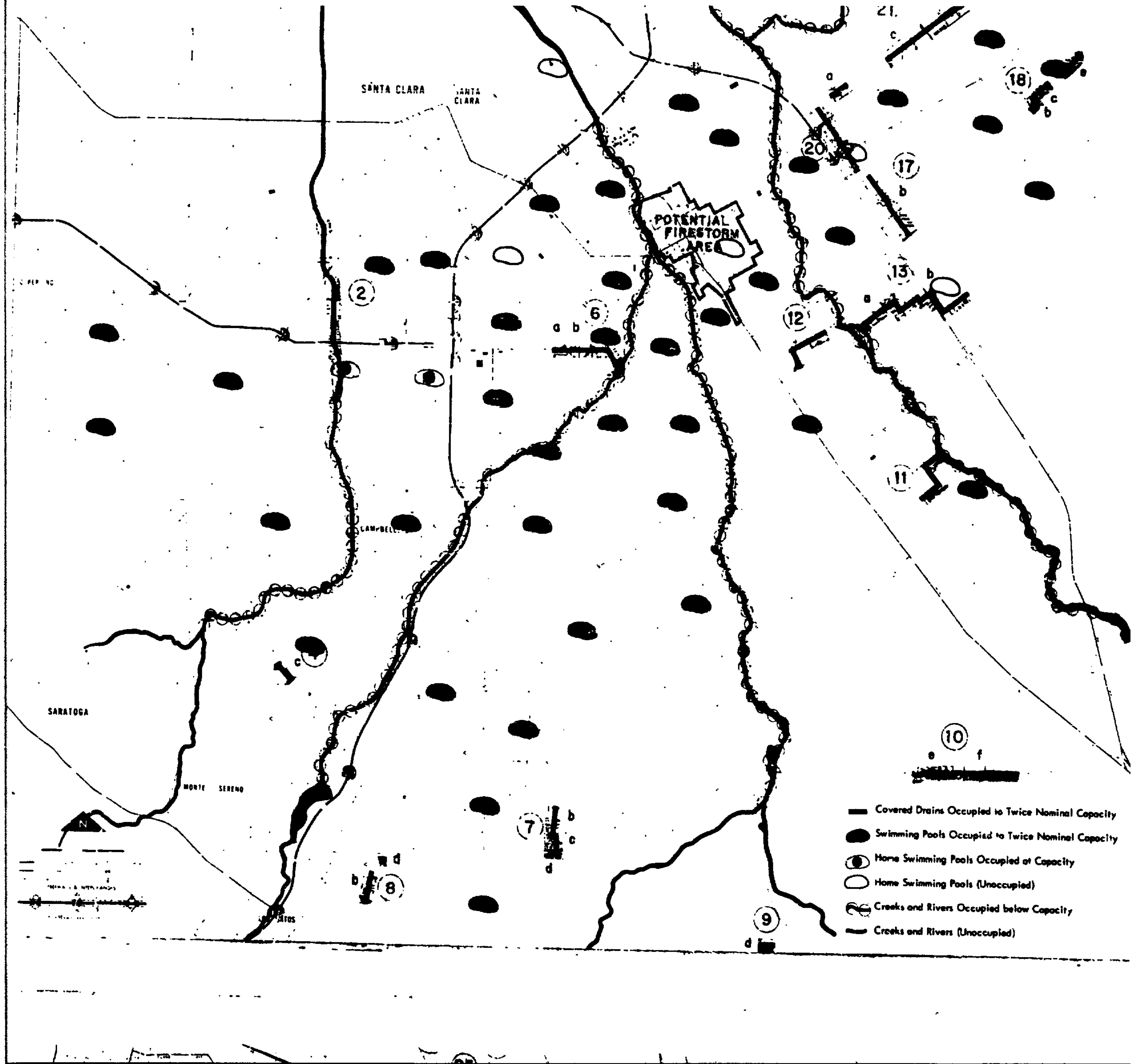
Comments

The facing map shows everyone in San Jose protected by (1) water immersion in creeks and rivers (2) water immersion in home swimming pools (occupancy twice nominal capacity) and (3) shelter in existing covered drainage facilities (occupancy twice nominal capacity). The Characteristic Curves for this PLAN Ib are presented below. The time-to-shelter curve is very acceptable, and quite similar (although slightly inferior) to that for PLAN Ia. The protection provided when the designated facilities are occupied is worthwhile, but definitely inferior to PLAN Ia--because of the currently estimated superiority of shelter in covered trenches to water shielding by immersion. (As mentioned, some of this apparent superiority may be illusory.) Living conditions seem likely to be miserable.

The cost of providing this protection should be very low, and it could all be done well in advance and maintained on a permanent basis. (Water levels can be raised and will remain with some maintenance of check dams; trenches can be dug, but they cannot be maintained over extended periods of time in ordinary soil.) Thus in actual practice (if water shielding proves to be practical) a combination of PLANS Ia and Ib may be the best low-cost procedure for protection. Then the water levels of the creeks and rivers would be permanently raised ahead of time (perhaps as part of Park and Recreation plans, see Appendix D), and if and when nuclear attack threatened, covered trenches could be hastily prepared (according to previously prepared plans). If the trenches were not done in time, water shielding would be used. If the trenches were done in time, their superior protection would be exploited. And, just to carry this through, if nuclear attack of this region did not materialize, but protective trenches seemed to be a continuing need, one could replace the disintegrating earthen trenches with buried culverts (carrying no water) to yield permanent, dry, trench-type shielding.

Characteristic Curves





SANTA CLARA
SANTA CLARA
POTENTIAL FIRESTORM AREA
CAMPBELL
SARATOGA
MONTE SERENO
Covered Drains Occupied to Twice Nominal Capacity
Swimming Pools Occupied to Twice Nominal Capacity
Home Swimming Pools Occupied at Capacity
Home Swimming Pools (Unoccupied)
Creeks and Rivers Occupied below Capacity
Creeks and Rivers (Unoccupied)

PLAN II--DIRECT-EFFECTS REGION--IMPROVED STATUS QUO PLUS NEW ALMADEN MINES

Plan Definition

Build this area-wide shelter system protective against flash/blast/mass fire/fallout from (1) the Universal Protection that already exists in San Jose, in combination with (2) suitable NFSS Basement Shelters with ventilation added and upgraded against mass fire and blast. Nominal capacities may be doubled if necessary. Since no new protection is to be built for people remote from shelter, no maximum acceptable time or distance to shelter can be specified; no minimum protection can be required. One does the best he can with what he has. Water shielding is ignored.

To get an idea of the protective value of developing the New Almaden Mines as shelter, add the postulated capacity of the ventilated tunnels of those mines to the foregoing. Estimated mine capacity may be doubled if necessary.

Available Protective Resources

1. The Covered Drainage Facilities of San Jose.
   Shown on Figure 19. } These have a nominal total capacity of 34,500.
   Detailed in Table 3. } Their emergency capacity is twice this or 69,000.

2. Upgraded NFSS Basement Shelters (with Added Ventilation).
   Shown on Figure 17.
   Detailed in Table 2; Total Capacity = 93,785 (PF CAT 1-8).

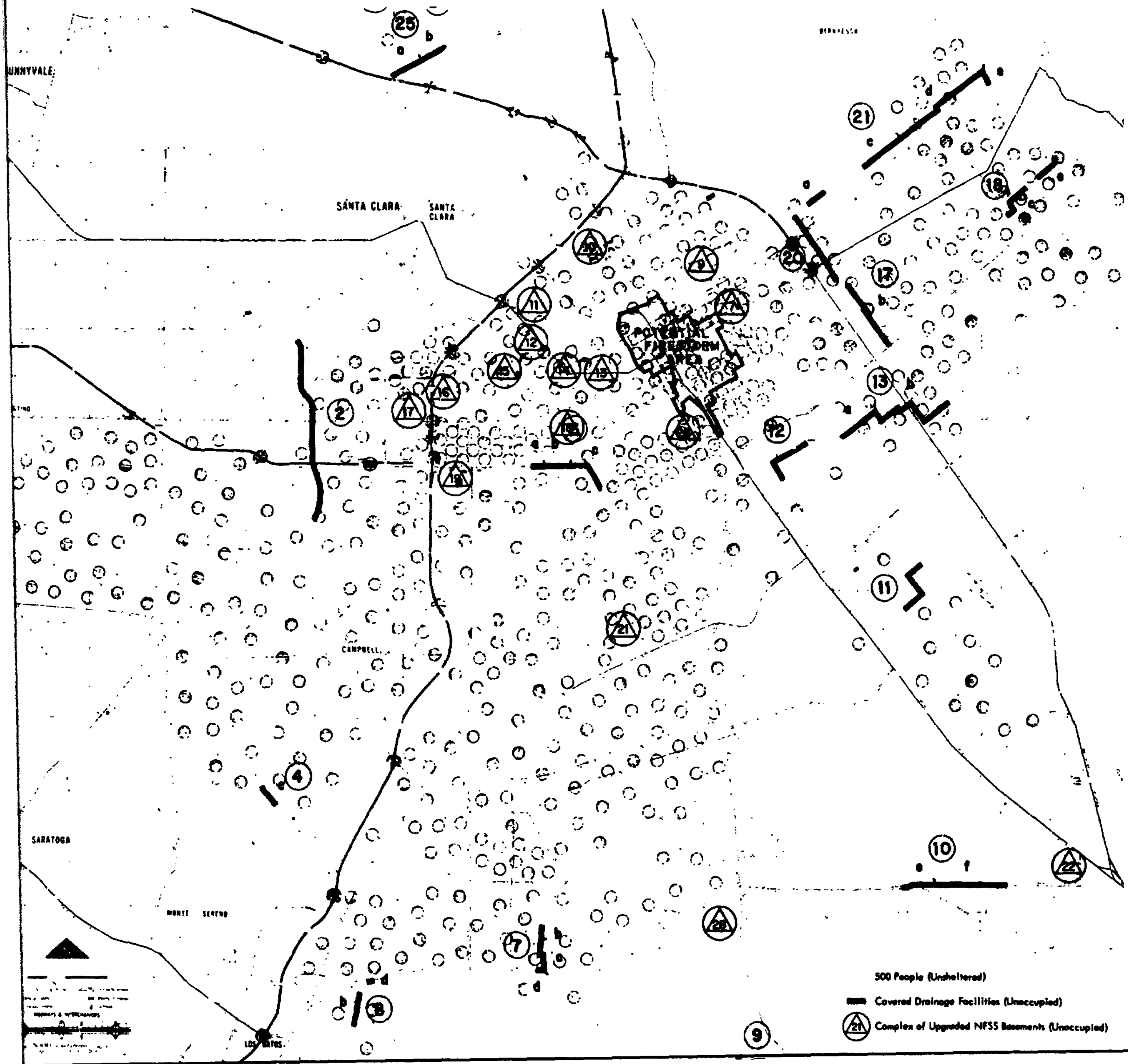
   Less Those in Potential Fire Storm Area or with Internal Fire Hazard.
   Detailed in Chapter 5; Total Capacity = -31,683 (PF CAT 1-8).

   Net Capacity = 62,102 (PF CAT 1-8)
   X 2 (reduced space allowance)
   Available Emergency Capacity= 124,204

With roughly 300,000 people to protect, it appears necessary to use the maximum possible occupancy of these facilities. With twice the nominal capacity in both existing drains and upgraded shelters there is emergency protection for some 193,000. The distributions of these protective resources and the population of San Jose are shown on the facing map. It can be seen that the protection is generally not colocated with the people. The inevitable consequence is longer times to get sheltered. And more shelter than that shown will be required to protect the entire population.

Supplemental Protection--New Almaden Mines

The additional protection needed could, of course, be provided in various ways. Since we have already considered shielding in emergent covered trenches hastily constructed in open areas under PLAN Ia, and water shielding by immersion in the standing water of streams in PLAN Ib, we can estimate at least roughly the consequences of using either or both of those two procedures without further analysis. We would rather try something new. Having proposed in Chapter IV the joint development of the New Almaden Mines as a Special Facility to provide shelter for much of the southern part of San Jose, we take this opportunity to see what impact the successful employment of those mines in this role would have. The capacity which might result from the development of the New Almaden Mines as permanent shelter is not known. We will assume a nominal value of 25,000, and a capability for compacting in an emergency by a factor of two, to 50,000 persons. The location of these mines is shown in Figure 18; they are off of the map used here.



SUNNYVALE
SANTA CLARA
SANTA CLARA
POTENTIAL FIRESTORM AREA
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
500 People (Unsheltered)
Covered Drainage Facilities (Unoccupied)
Complex of Upgraded NFSS Basements (Unoccupied)

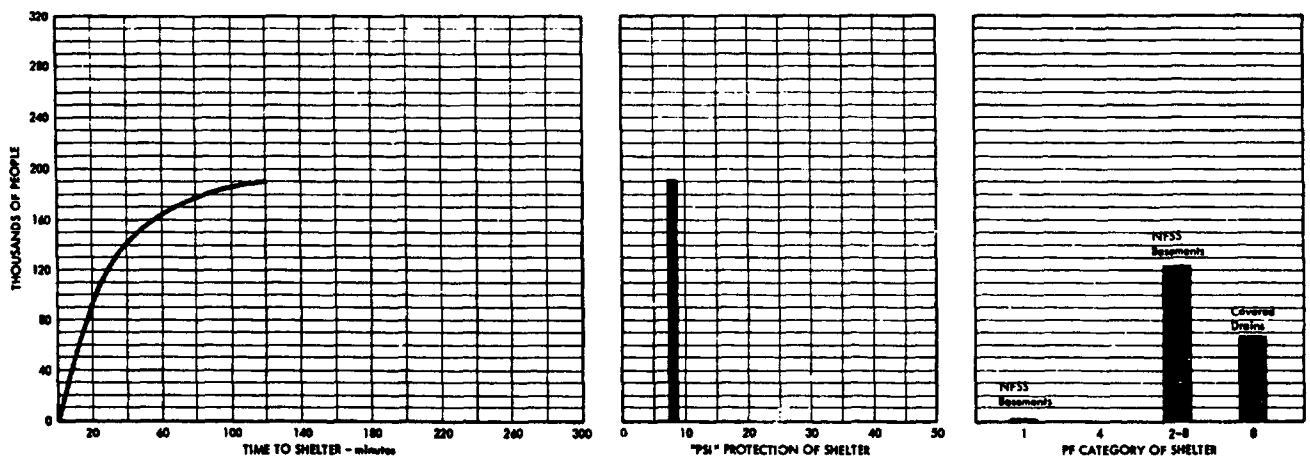
SHELTER IN UPGRADED NFSS BASEMENT SHELTERS (VENT ADDED) AND COVERED DRAINS (OCCUPANCY DOUBLED IN BOTH)

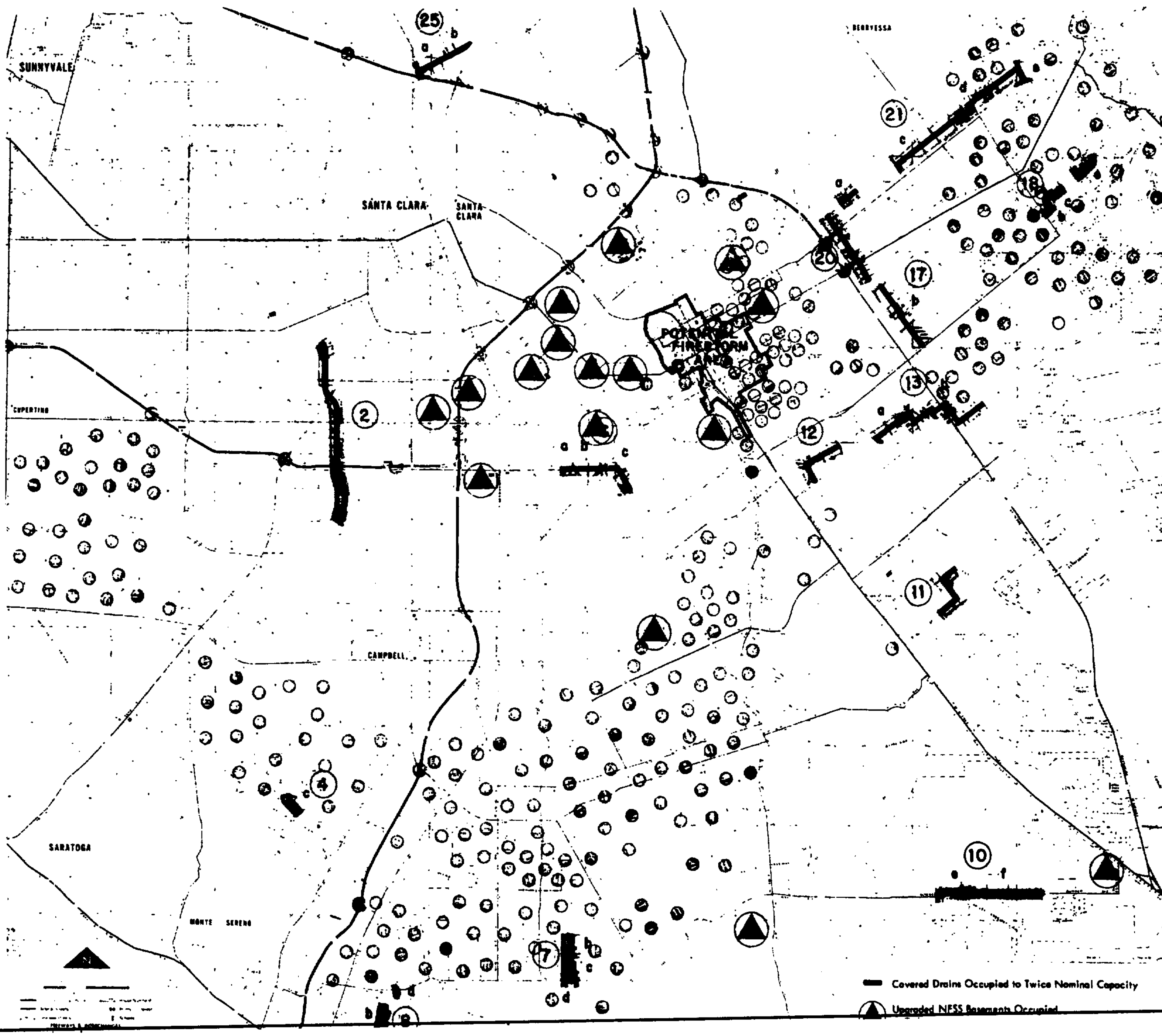
Comments

The facing map shows the approximate consequences of occupying at twice nominal capacity (maximum emergency crowding) the upgraded NFSS Basement Shelters and the existing Covered Drainage Facilities. Many people are, of course, still without protection of any kind. Characteristic Curves for this shelter system are below. Comparing the time-to-shelter curve shown here with the similar ones for PLAN Ia (Covered Drainage) and PLAN Ib (Covered Drainage + Swimming Pools) reveals that (1) many people are more nearly colocated with NFSS Basement Shelters than with Covered Drainage Facilities, but (2) many people are normally closer still to Home Swimming Pools. And (3) because of the large capacities of some NFSS Basement Shelters, the people nearby are used up before those shelters are filled--hence we have to reach out for people who are not nearby and the time-to-shelter swells to 2 hours (in Plans Ia and Ib it never exceeds 40 minutes). As to the quality of protection, because Upgraded NFSS Basements are judged more protective than Swimming Pools, and the same Covered Drains are used in all, this much of PLAN II offers better protection--but farther away--than the similar portion of PLAN Ib.

PLAN II brings (1) protection which is permanent and (2) living conditions which are vastly improved--neither of these show on the Characteristic Curves. Upgraded NFSS Basement Shelters are permanent structures of reinforced concrete, prepared to provide protection now and hereafter (and requiring very little maintenance). The living conditions therein should be far less miserable than in raw earth trenches or immersed in water. The postulated upgrading of NFSS Basement Shelters for this PLAN II, however, carries its own set of difficulties. While we know how to keep flash and fire out of such ordinary structures, we do not yet know of a low-cost procedure for insuring that its occupants receive air which is breathable while the community burns. Inexpensive procedures for supplying breathable air to people in shelters ventilated by blast (so the spaces cannot be sealed) are presently unknown. Their development is sorely needed. Lastly, the actual process of upgrading private property for the benefit of community protection may be sticky.

Characteristic Curves





SUNNYVALE
SANTA CLARA
SANTA CLARA
BERRYESSA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
POTENTIAL FIRESTORM AREA
25
21
18
20
17
13
12
11
10
2
4
7
Covered Drains Occupied to Twice Nominal Capacity
Upgraded NFSS Basements Occupied

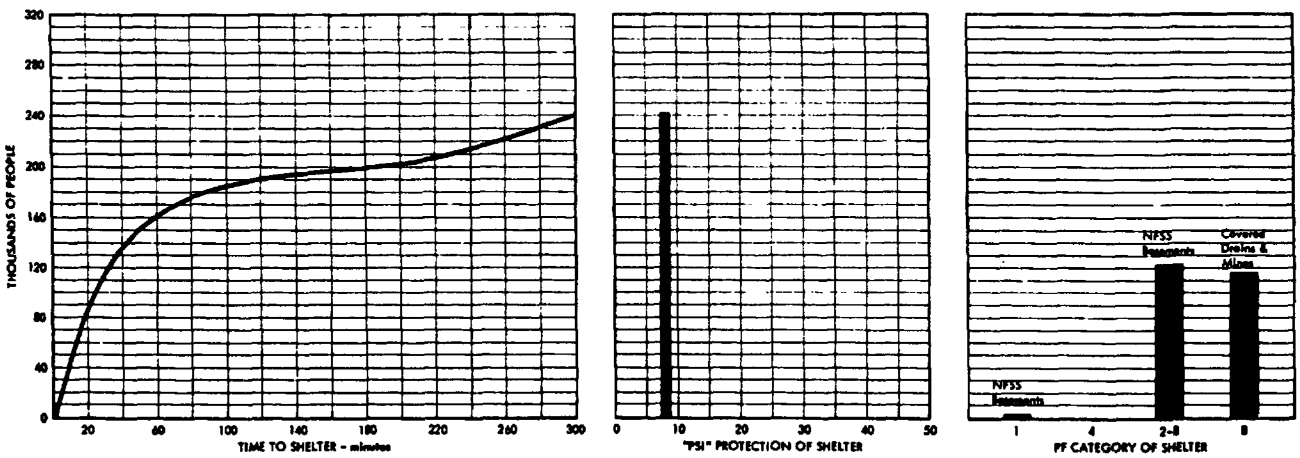
SHELTER SAME AS PRECEDING, SUPPLEMENTED BY NEW ALMADEN MINES (ALL OCCUPANCIES DOUBLED)

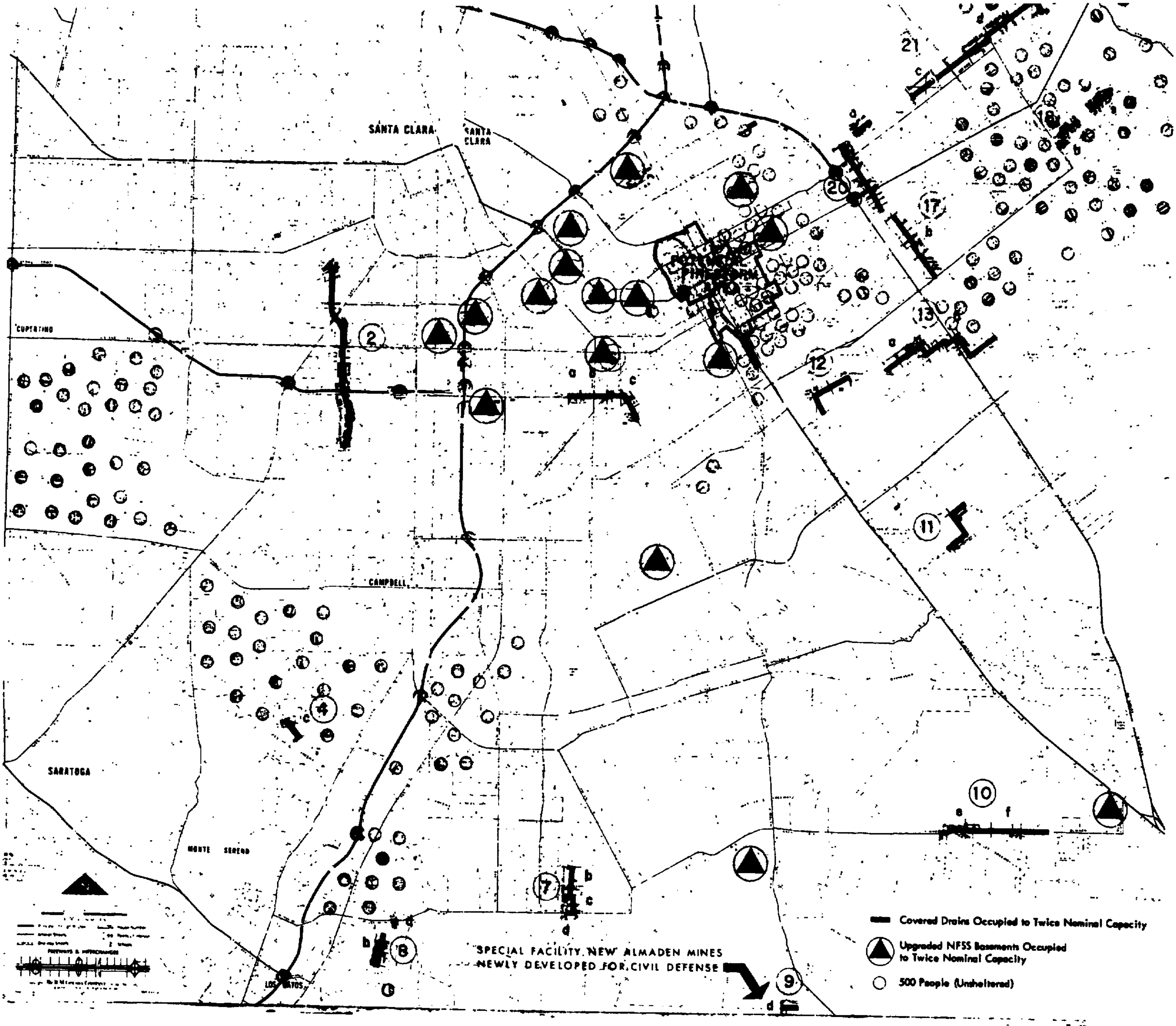
Comments

Adding the New Almaden Mines to the selected upgraded NFSS Basement Shelters and the existing Covered Drainage Facilities in San Jose produces the result depicted on the facing map. All nominal capacities have been doubled. Some residual unsheltered population dots remain because we have made no particular effort in this PLAN to positively shelter everyone. Those remaining could be provided with the last-minute protection of emergent covered trenches in open areas, or some similar product from a program for increased emergency-readiness. The Characteristic Curves for the total protection of PLAN II are given below.

Since the New Almaden Mines are about 8 miles from the nearest part of San Jose containing previously unsheltered people, it was expected that the time for loading would be long when those mines were used as shelter. However, since the direction of travel was away from town and there was known to be space available for parking near the mines, there seemed to be no harm in allowing people who so desired to use cars to get to this Special Facility. Not having thought it through, it thus came as a surprise to discover that even when cars were used the mines could not be loaded quickly with the postulated 50,000 people. The capacity of the road leading thereto was much too small. While we have not considered all possible procedures for moving people to this proposed shelter, those that we have analyzed produced results no better than walking. Therefore, in spite of our willingness to change the rules to speed up the loading of the New Almaden Mines, PLAN II is based on walking all that way. A very extended loading time results. (A similar thing would happen if the principal downtown NFSS shelters were increased in capacity a like amount and people continued to walk to them.) On the other side of the coin, the quality of the protection potentially available in the mines (while difficult to estimate at this time) is good, and seems likely to compare favorably to the competitive alternatives. (We have no estimate at all for the cost of realizing shelter as part of the redevelopment of these mines.) While the use of the New Almaden Mines for passive protection only appears here under PLAN II, it could be a part of many other combinations of protective facilities (and with similar consequences).

Characteristic Curves





SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
SPECIAL FACILITY, NEW ALMADEN MINES
NEWLY DEVELOPED FOR CIVIL DEFENSE
Covered Drains Occupied to Twice Nominal Capacity
Upgraded NFSS Basements Occupied to Twice Nominal Capacity
500 People (Unsheltered)

PLAN III--DIRECT-EFFECTS REGION--IDEAL BLAST PROTECTION (ALL NEW SHELTERS)

Plan Definition

Build all new blast shelters with specified protection against flash/blast/mass fire/fallout in the interiors of selected large incombustible open areas within the community: existing public school grounds and parks in San Jose. Strive for a time to shelter no greater than 30 minutes. (However, since the time to shelter is ultimately determined by the relations between acceptable open areas and the population to be sheltered, no predetermined, maximum time or distance to shelter can be guaranteed in advance, unless new open areas can be created where needed. This PLAN does not include making new open areas available for use as shelter sites--only existing ones are considered.)

No protection from any other previous PLAN is used here; this PLAN III depends entirely on all new construction.

Available Protective Resources

The sites to be considered for the construction of the specified new blast shelters are limited to:

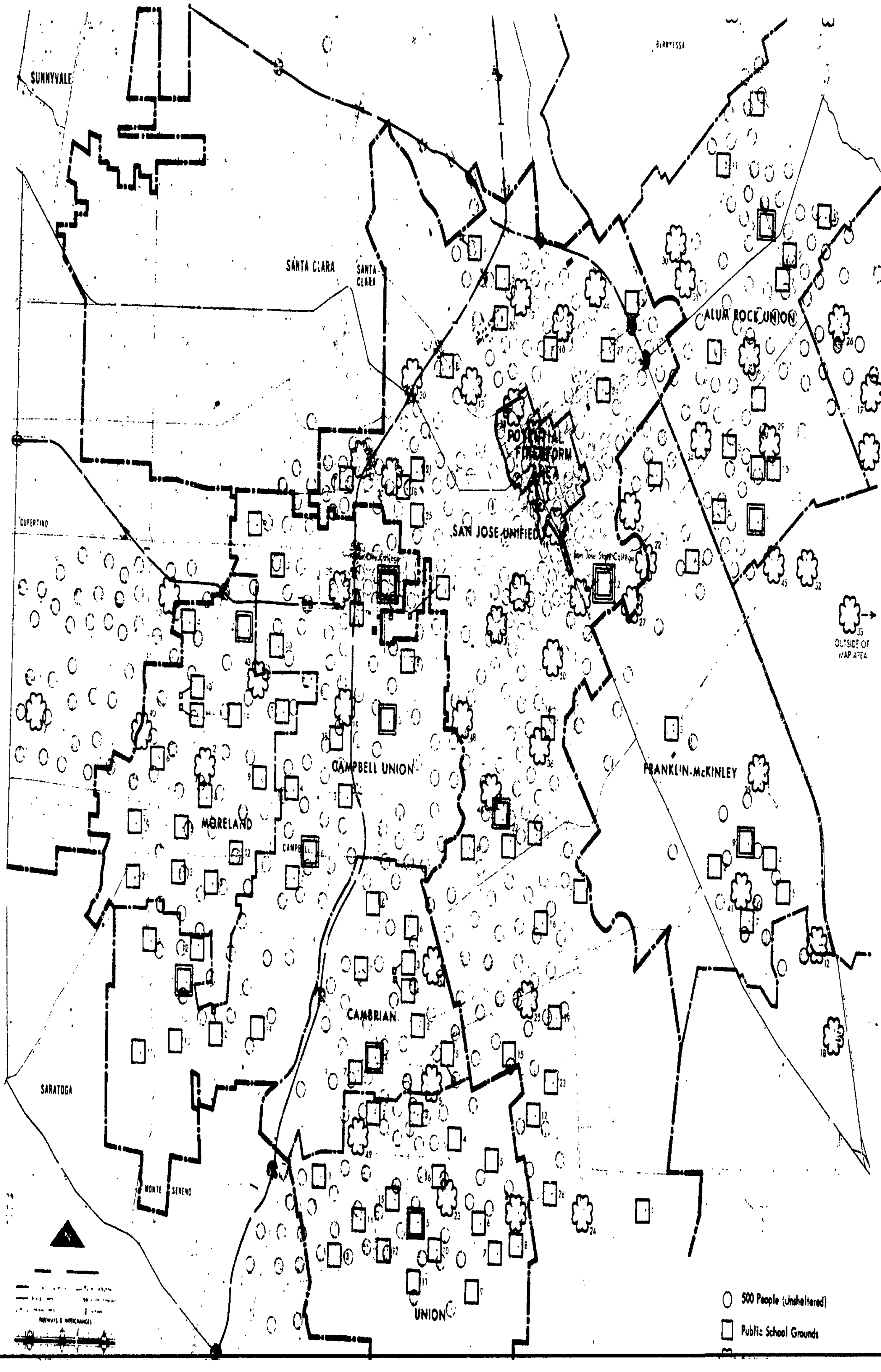
1. Selected Public School Grounds in San Jose.
   Shown on Figure 22.
   Detailed in Appendix E.
   } These have a nominal total capacity of 1,456,000.

2. Selected Public Parks (and Golf Courses) of San Jose.
   Shown on Figure 23.
   Detailed in Appendix F.
   } These have a nominal total capacity of 842,000.

Their distribution relative to the resident population is shown on the facing map. From previous analyses (especially PLAN Ia) we know that the candidate open areas are well located with respect to the people to be protected.

The size of the new blast shelter to build in each open area utilized is given in Table 9 at the end of the description of this PLAN. The capacities shown are nominal, and more crowded occupancies are not envisioned. (Emergency-crowded new shelters constitute an important alternative, of course, and this policy was employed by San Jose officials in developing their own 1962 plan for community shelter--especially during the building period when the system of usable shelters is still incomplete.)

The suggested blast resistance for these newly constructed shelters is 30 psi. People within such structures should be "as good as new" after experiencing a blast wave (from a nuclear explosion in the megatons) whose peak overpressure is 30 psi. We assume that "appreciable deaths" (20-25% of the occupants) occur in these structures when they are subjected to a blast of about 50 psi.


SUNNYVALE
SANTA CLARA
SANTA CLARA
POTENTIAL FIRESTORM AREA
ALUM ROCK UNION
SAN JOSE UNIFIED
San Jose State College
OUTSIDE OF MAP AREA
CUPERTINO
CAMPBELL UNION
MORELAND
CAMPBELL
FRANKLIN-McKINLEY
CAMBRIAN
SARATOGA
MONTE SERENO
UNION
500 People (Unsheltered)
Public School Grounds

SHELTER PROVIDED ENTIRELY BY NEW BLAST SHELTERS CONSTRUCTED IN SELECTED OPEN AREAS (NOMINAL CAPACITY)

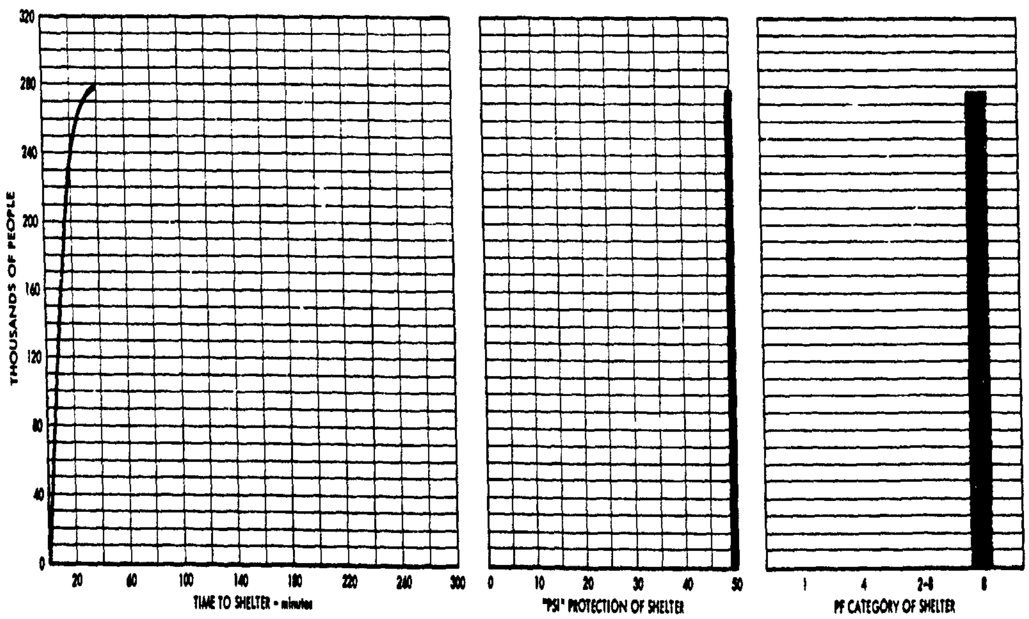
Comments

Here we see for the first time protection provided for the community commensurate with its needs. "Everyone" on the facing map is sheltered and, as the first of the Characteristic Curves below reveal, sheltered in very good time. With this area-wide shelter system of PLAN III, about half the population is within 10 minutes of its protection; and only about 8,000 people out of the 280,000 considered are more than 30 minutes away--and they are within 40 minutes of shelter. (The 8,000 people "tail" beyond 30 minutes is caused by the downtown, where builtupness and mass fire possibilities force the nearest new shelters to be built in existing open areas that are farther away than the general rule.) The time-to-shelter characteristics are determined by the relative distributions of suitable public school grounds and parks, and the resident population. Those relations are seen to be good in San Jose (and they would be very difficult and expensive to improve). The size of each new shelter to be constructed is given in Table 9.

The quality of the protection is dependent on whatever is built. Both lesser and greater protections are conceivable and if employed would result in changes that are easy to visualize in the 2nd and 3rd of the Characteristic Curves. Different degrees of protection could also be considered for different parts of town. In any case the protection would be permanent, ready for instant use against any future nuclear emergency. Moreover the living conditions in shelter would be much better than anything previously considered here. This protection would be superior in every way (including cost).

The important point is that the protection judged necessary can be provided, for a price (and for San Jose the price of PLAN III would certainly not be prohibitive). But such protection--in Direct-Effects Regions--generally requires the abandonment of the use of existing buildings, and the construction of new blast shelters specifically designed for that purpose. Only in this way can the effective size of enemy nuclear weapons exploding near our people be greatly reduced at reasonable cost.

Characteristic Curves



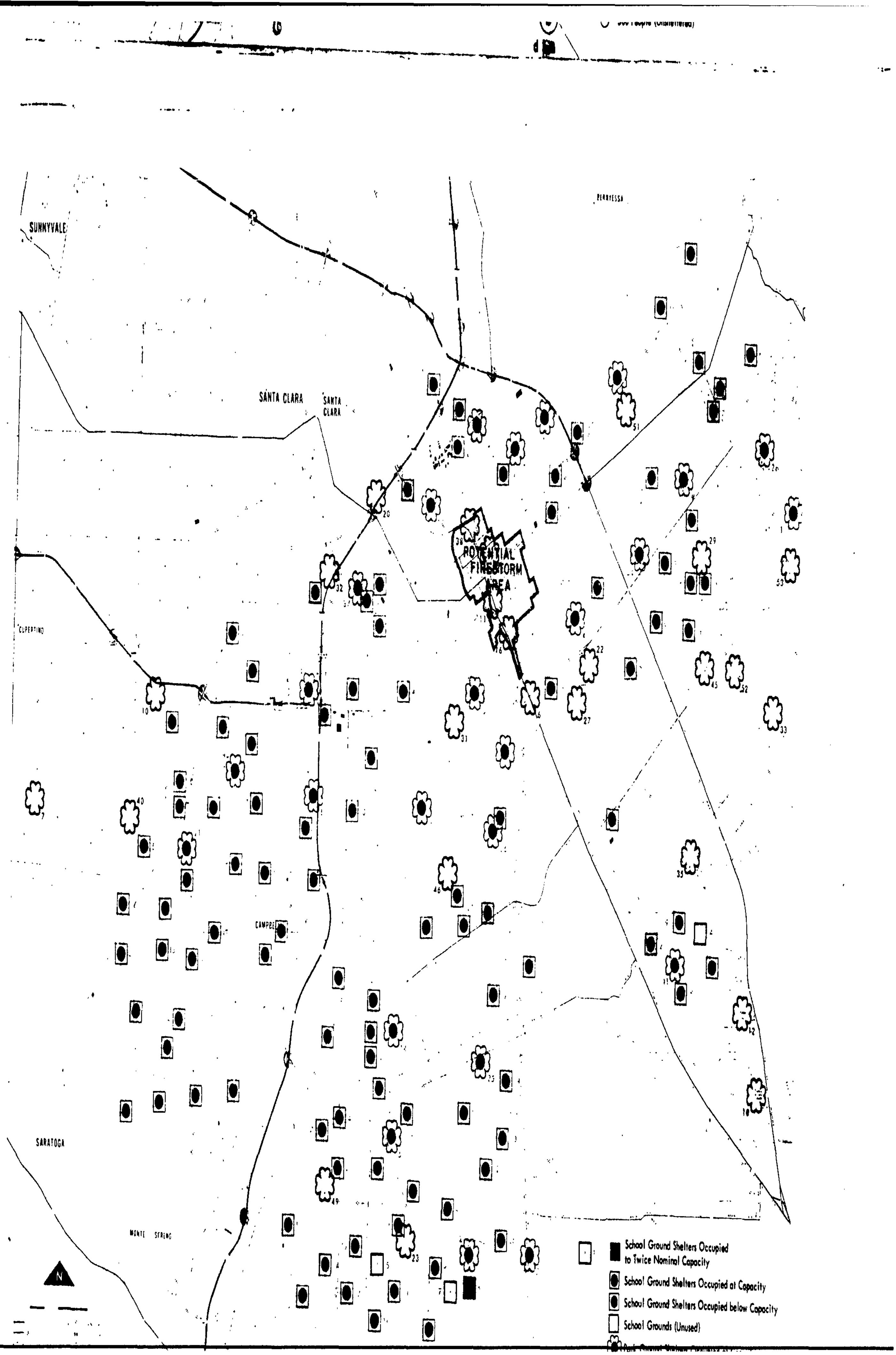

SUNNYVALE
PERRYESSA
SANTA CLARA
SANTA CLARA
POTENTIAL FIRESTORM AREA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
N
School Ground Shelters Occupied to Twice Nominal Capacity
School Ground Shelters Occupied at Capacity
School Ground Shelters Occupied below Capacity
School Grounds (Unused)

Table 9

THE USE OF PUBLIC SCHOOL GROUNDS AND PARKS AS SITES FOR NEW BLAST SHELTERS FOR PLAN III

COLLEGIATE FIELDS

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	56,000	1,875	2,250	0	0	4,125
2	132,400	500	1,625	1,875	1,000	5,000
	Total	2,375	3,875	1,875	1,000	9,125

CAMPBELL ELEMENTARY

NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	23,000	1,250	500			1,750
2	2,600	1,500	500			2,000
3	3,200	500	0			500
4	5,000	1,750	800			2,550
5	7,000	1,250	1,000			2,250
6	6,600	1,000	0			1,000
7	12,900	1,000	0			1,000
8	10,500	1,250	1,000			2,250
9	7,150	500	500	1,000		2,000
10	11,000	1,000	500			1,500
11	3,680	500	500			1,000
12	9,520	1,000	500			1,500
13	2,000	0	500			500
14	8,000	1,000	750			1,750
15	7,000	1,250	1,250			2,500
	Total	14,750	8,300	1,000		24,050

SAN JOSE UNIFIED

NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	1,260	0	0	0	0	0
2	5,760	1,500	250	250	250	2,250
3	8,250	1,250	250	0	1,000	2,500
4	9,520	2,000	2,500	500	0	5,000
5	1,280	1,000	0	375	0	1,375
6	7,430	1,000	1,750	1,000	0	3,750
7	4,380	250	875	0	0	1,175
8	1,380	1,125	125	0	0	1,250
9	2,410	2,500	0	0	0	2,500
10	1,845	2,000	0	0	0	2,000
11	9,380	0	0	0	0	0
12	15,150	1,000	0	0	0	1,000
13	1,660	1,500	250	0	0	1,750

SAN JOSE UNIFIED (Continued)

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
14	7,090	1,000	0	500	0	1,500
15	1,920	1,000	625	0	0	1,625
16	7,557	1,625	500	0		2,125
17	-	-	-	-	-	-
18	2,250	2,000	0	0		2,000
19	5,645	1,000	0	125		1,125
20	10,190	1,500	3,250	0		3,750
21	21,600	1,125	1,000	1,000		3,125
22	58,000	3,000	1,875	375		5,250
23	9,200	375	1,625	375		2,375
24	10,700	2,250	2,875	0		5,125
25	29,600	1,000	2,500	0	250	3,750
26	68,000	375	1,125	0		1,500
27	17,500	500	375	500		1,375
	Total	31,875	21,750	5,000	1,500	60,125

CAMPBELL UNION HIGH SCHOOL

NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	66,000	500	0			500
2	65,000	0	750			750
3	48,000	2,000	500	500		3,000
4	24,144	1,000	0			1,000
5	55,500	0	0			0
6	22,500	2,000	250			2,250
	Total	5,500	1,500	500		7,500

MORELAND ELEMENTARY

NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	0	0	0			0
2	9,100	500	500			1,000
3	4,500	1,000	500			1,500
4	9,000	1,000	2,500			3,500
5	19,400	700	0			700
6	6,200	1,500	750			2,250
7	880	1,000	0			1,000
8	2,000	1,250	0			1,250
9	4,000	900	500			1,400
10	3,800	500	0			500

TABLE 9 (Continued)

MORELAND ELEMENTARY (Continued)

SCHOOL NO.	SCHOOL CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
11	24,000	1,000	0			1,000
12	5,700	600	500			1,100
13	4,800	600	750			1,350
14	4,800	800	0			800
15	-	-	-			-
16	6,050	500	50			1,000
	Total	11,850	6,500			18,350

CAMBRIAN ELEMENTARY

SCHOOL NO.	SCHOOL CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	3,140	1,250	1,300			2,250
2	11,950	1,200	500			1,700
3	21,600	250	0			250
4	3,760	750	0			750
5	5,600	750	500			1,250
6	3,840	1,000	2,250			3,250
7	3,840	1,250	1,250			2,500
8	4,150	1,000	1,000	1,000		3,000
	Total	7,450	6,800	1,000		15,250

UNION ELEMENTARY

SCHOOL NO.	SCHOOL CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	5,068	1,250	2,000			3,250
2	5,040	1,600	1,000			2,600
3	8,840	2,300	1,500			3,800
4	11,200	750	500			1,250
5	18,000	500	0			500
6	10,600	1,000	0	-	-	1,000
7	45,200	0	0	-	-	0
8	280	500	0	-	-	500
9	12,600	500	500	-	-	1,000
10	13,100	1,250	0	-	-	1,250
11	3,000	750	0	-	-	750
12	9,400	1,250	0	-	-	1,250
13	7,200	1,500	600	1,500	2,000	5,600
14	23,200	600	0	-	-	600
15	9,740	700	200	-	-	900
16	3,370	800	800	-	-	1,600
	Total	15,250	7,100	1,500	2,000	25,850

ALUM ROCK UNION HIGH SCHOOL

SCHOOL NO.	SCHOOL CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	62,500	1,500	500	-	-	2,000
2	42,500	1,200	2,000	-	-	3,200

ALUM ROCK ELEMENTARY

SCHOOL NO.	SCHOOL CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	13,500	1,250	1,250	-	-	2,500
2	3,600	1,250	2,500	-	-	3,750
3	2,750	1,250	0	-	-	1,250
4	37,000	1,000	0	-	-	1,000
5	10,600	1,500	1,000	-	-	2,500
6	11,000	2,300	500	-	-	2,800
7	1,500	1,500	0	-	-	1,500
8	32,000	1,250	1,500	-	-	3,750
9	6,000	1,500	3,000	-	-	4,500
10	27,000	0	500	-	-	500
11	9,000	1,500	1,000	-	-	2,500
	Total	17,000	13,750	0	0	30,750

FRANKLIN McKINLEY

SCHOOL NO.	SCHOOL CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	7,210	2,000	1,000	-	-	3,000
2	1,260	250	500	500	-	1,250
3	6,700	0	500	1,000	-	1,500
4	16,000	0	0	0	-	0
5	3,920	500	1,000	500	-	2,000
6	3,350	1,500	1,000	500	-	3,000
7	4,050	1,000	0	0	-	1,000
8	-	-	-	-	-	-
9	16,600	700	500	-	-	1,200
	Total	5,950	4,500	2,500	0	12,950

PARKS

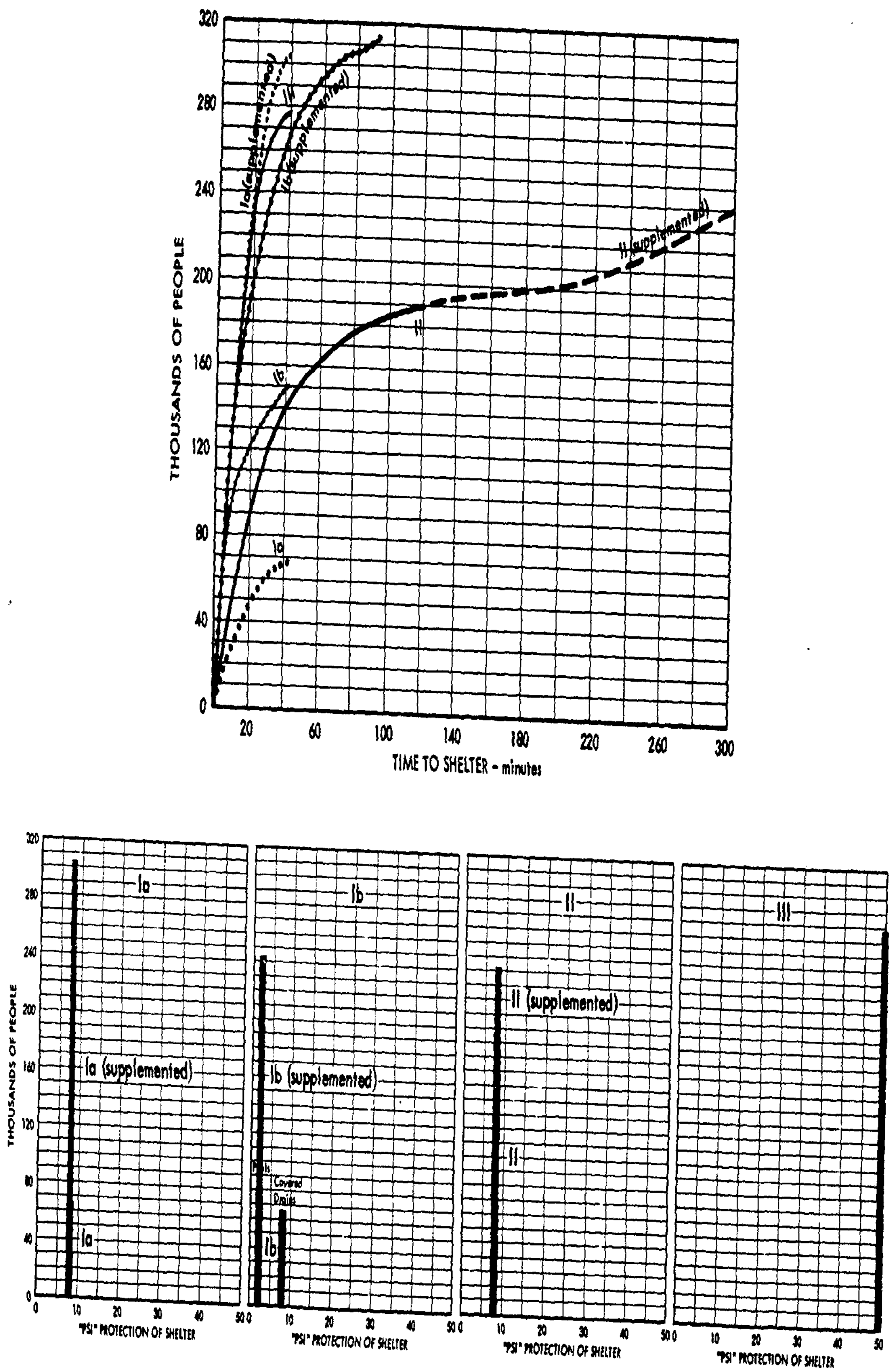
SCHOOL NO.	SCHOOL CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	-	-	-	-	-	-
2	8,500	0	-	-	-	0
3	7,800	1,500	1,000	4,500	0	7,000
4	19,000	1,250	2,000	2,000	3,500	8,750
5	3,200	250	0	-	-	250
6	0	-	-	-	-	0
7	8,700	-	-	-	-	0

TABLE 9 (Continued)

PARKS (Continued)		INCREMENTAL OCCUPANCY (MINUTES)				
NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
8	10,000	-	-	-	-	0
9	10,000	1,750	0	-	-	1,750
10	8,400	-	-	-	-	0
11	0	-	-	-	-	0
12	0	-	-	-	-	0
13	7,600	1,500	3,625	1,500	1,250	7,375
14	6,100	1,000	0	-	-	1,000
15	500	0	500	-	-	500
16	0	-	-	-	-	0
17	-	500	-	-	-	500
18	-	-	-	-	-	0
19	4,500	1,500	1,500	-	-	3,000
20	0	-	-	-	-	0
21	6,100	500	0	-	-	500
22	44,000	-	-	-	-	-
23	-	-	-	-	-	-
24	-	500	-	-	-	500
25	-	2,000	1,500	1,000	-	4,500
26	-	1,500	1,500	-	-	3,000
27	-	-	-	-	-	-
28	-	-	-	-	-	-
29	-	-	-	-	-	-
30	-	500	-	-	-	500
31	0	-	-	-	-	-
32	0	-	-	-	-	-
33	-	-	-	-	-	-
34	-	1,500	0	-	-	1,500
35	-	-	-	-	-	-
36	8,800	1,750	2,500	500	-	4,750
37	3,800	250	875	3,000	-	4,150
38	-	-	-	-	-	-
39	6,700	1,000	3,000	0	-	4,000
40	500	-	-	-	-	0
41	-	250	-	-	-	250
42	0	-	-	-	-	0
43	4,700	700	500	0	-	1,200
44	25,400	1,250	-	-	-	1,250

PARKS (Continued)		INCREMENTAL OCCUPANCY (MINUTES)				
NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
45	5,800	-	-	-	-	0
46	0	0	-	-	-	0
47	22,000	2,250	4,000	1,500	-	7,750
48	7,400	2,125	0	1,125	0	3,250
49	378,000	0	-	-	-	0
50	24,000	500	3,000	3,500	-	7,000
	Total	26,325	25,500	18,125	4,750	73,700

SUMMARY OF CHARACTERISTIC CURVES OF AREA-WIDE SHELTER SYSTEMS FOR SAN JOSE AS A DIRECT-EFFECTS REGION



PLAN A--FALLOUT-ONLY REGION--STRICTLY STATUS QUO (NO WATER SHIELDING)

Plan Definition

Provide the best possible protection from radioactive fallout for the people of San Jose (Fallout Only) using only the physical facilities which already exist in San Jose. Nothing new is to be built; no improvements are to be obtained by modifications. No protection against flash, blast or mass fire is required. Nominal capacities may be doubled if necessary. Since no new protection is contemplated, no maximum acceptable time or distance to shelter can be specified; no minimum Protection Factor can be required. Water shielding is ignored.

If enough shelter for the population does not result from the foregoing, dig foxholes or covered trenches for those yet unshielded, as part of a program for increased emergency-readiness in response to a serious threat of nuclear attack.

Available Protective Resources

The immediately usable assets in San Jose (Fallout Only) are:

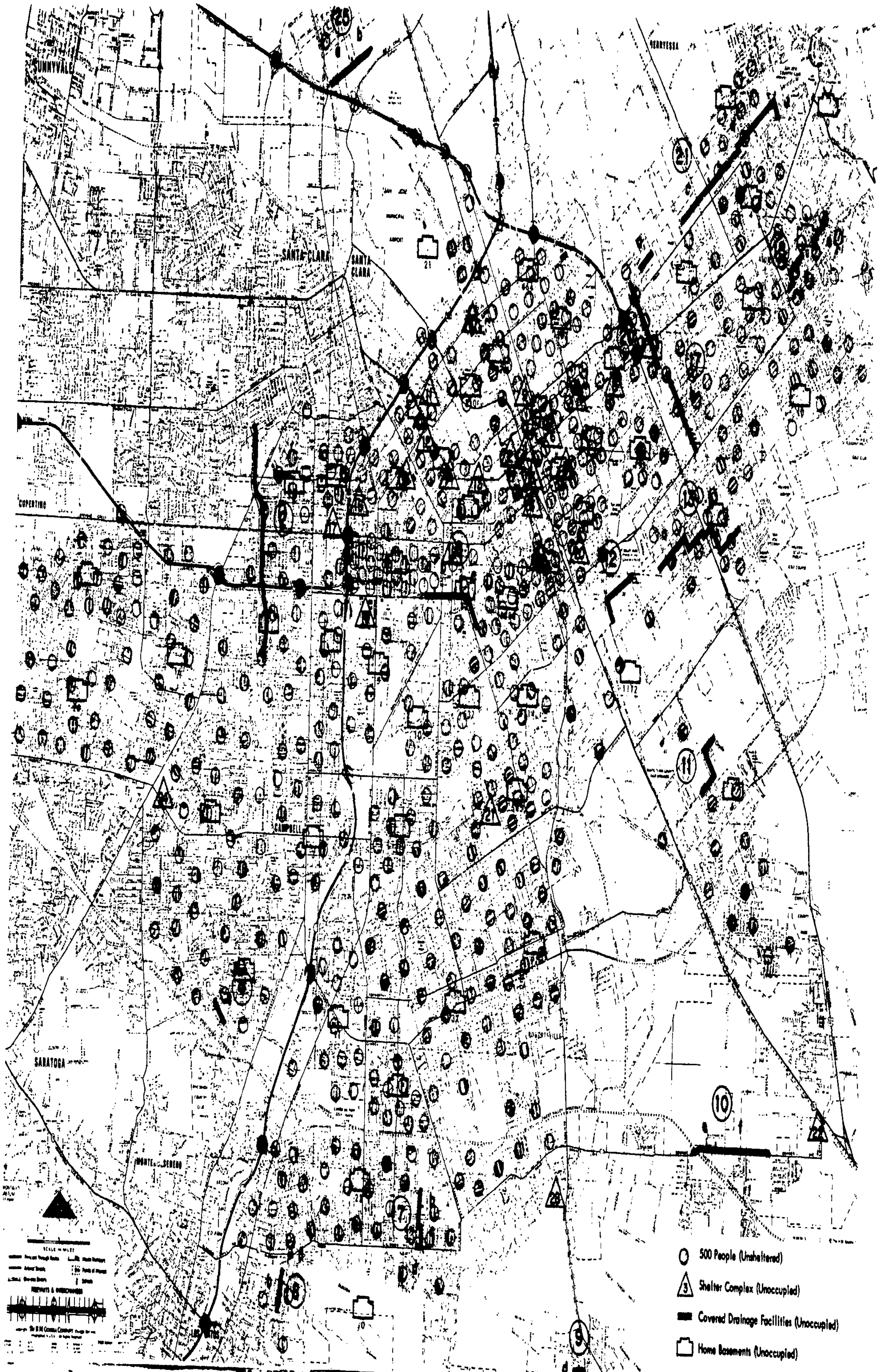
1. The NFSS Shelters, both above and belowground, without added ventilation.
   Shown on Figures 32 and 33. These have a total nominal capacity of 131,589, PF Cat 1-8.
   Detailed in Table 6 ("As Is"). Their emergency capacity is twice this or 263,178.

2. The Covered Drainage Facilities.
   Shown on Figure 19. These have a total nominal capacity of 34,500.
   Detailed in Table 3. Their emergency capacity is twice this or 69,000.

3. The Home Basements
   Shown on Figure 27.
   Estimated to have a total nominal capacity of about 60,000 @ 3 per dwelling unit.
   Their emergency capacity is twice this or 120,000.

If all capacities were doubled, there would be emergency fallout shelter for some 452,178 people--well in excess of the population to be protected. Hence additional last-minute shelter/shielding through programs for increased emergency-readiness may not be needed.

The map on the facing page records the approximate spatial relations between these available protective resources and the population.


SUNNYVALE
SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
BERRYESSA
500 People (Unsheltered)
Shelter Complex (Unoccupied)
Covered Drainage Facilities (Unoccupied)
Home Basements (Unoccupied)

FALLOUT SHELTER IN NFSS SHELTERS (CAT ≥ 1), COVERED DRAINS AND HOME BASEMENTS (ALL "AS IS" AND OCCUPANCY DOUBLED)

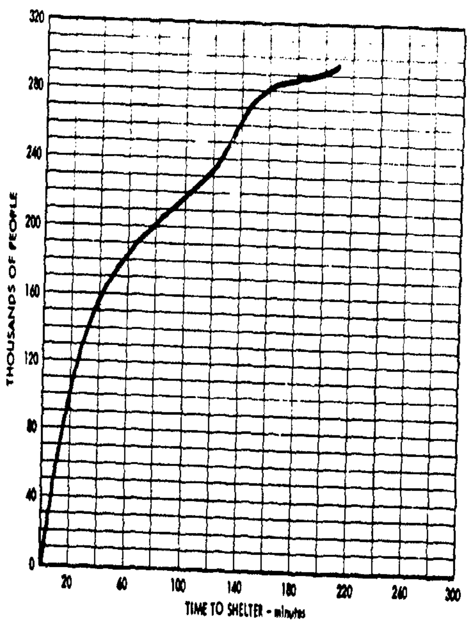
Comments

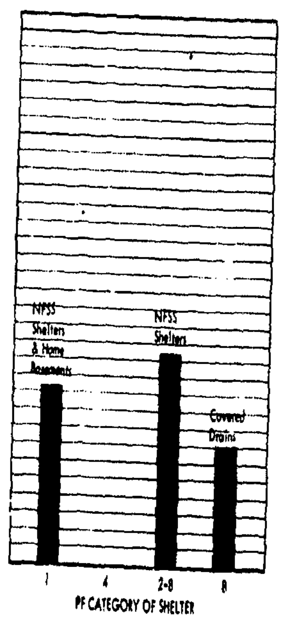
This PLAN shows an arrangement which provides in existing facilities emergency shelter for all of the people of San Jose--if radioactive fallout was all they had to face. Much of the fallout shelter used, (and displayed on the facing map) is of inferior quality with regard to (1) loading time, (2) Protection Factor, (3) shelter space per person, or (4) living conditions. It is all permanent space however, available at very low cost (for civil defense use).

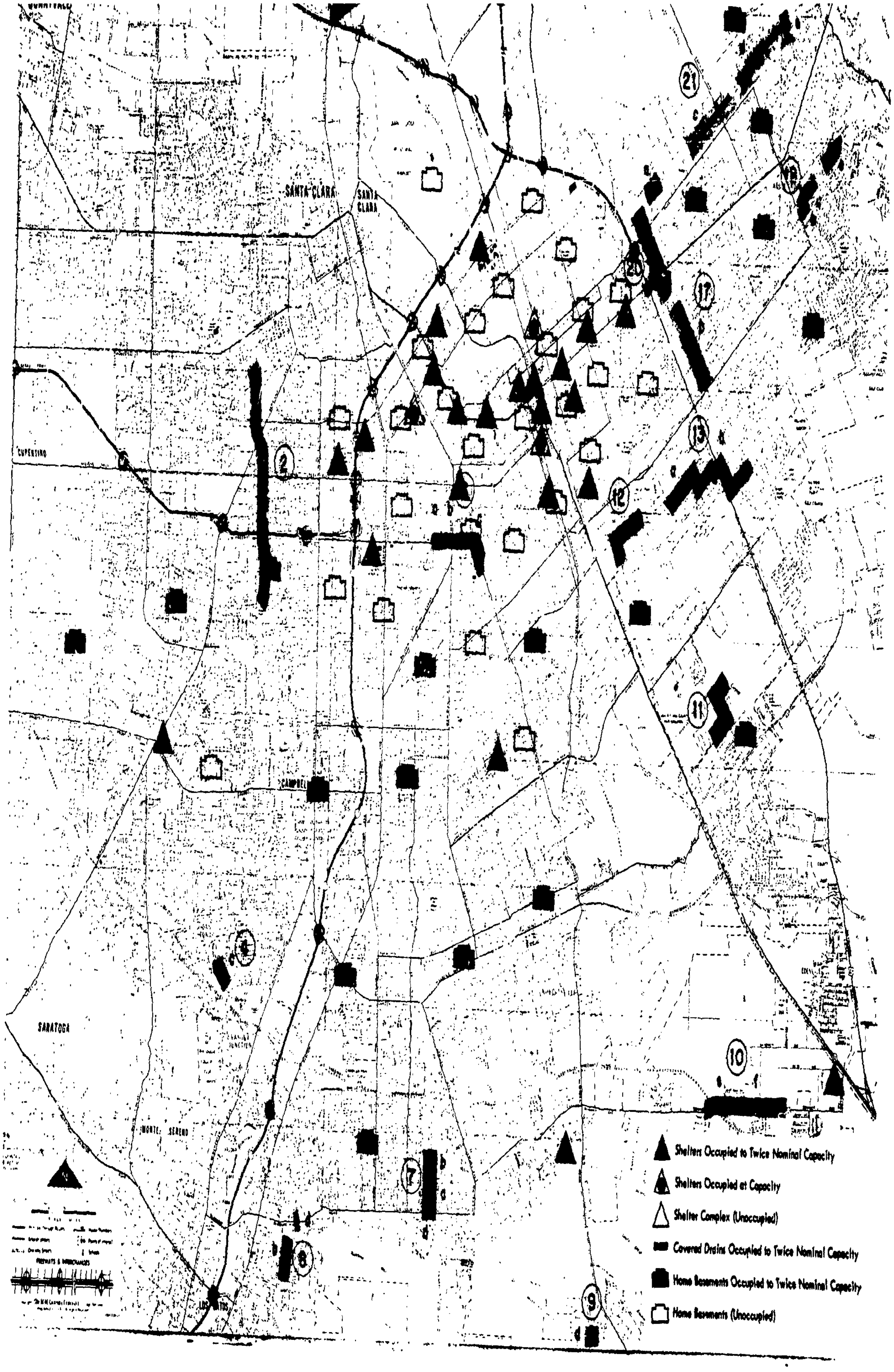
The Characteristic Curves below show the somewhat prolonged time-to-shelter of this system. Three and a half hours are required to shelter everyone (because of the large capacity NFSS facilities); only about half the population is within 30 minutes of its protection.

The quality of protection, once people are sheltered, ranges from very good (PF Cat. 8) to poor (PF Cat. 1). The low grade contribution comes from the PF Category 1 spaces identified by the NFSS, and from the home basements (all assumed to be Category 1). Over 100,000 people are placed in these Category 1 shelters (at twice the nominal occupying density).

Characteristic Curves






SANTA CLARA
SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
21
19
20
17
13
12
11
10
2
7
8
9
Shelters Occupied to Twice Nominal Capacity
Shelters Occupied at Capacity
Shelter Complex (Unoccupied)
Covered Drains Occupied to Twice Nominal Capacity
Home Basements Occupied to Twice Nominal Capacity
Home Basements (Unoccupied)
FREEWAYS & INTERCHANGES

PLAN B1--FALLOUT-ONLY REGION--IMPROVED STATUS QUO FOR BETTER PROTECTION

Plan Definition

Take the protective resources of PLAN A and add to them the shelter spaces in San Jose (Fallout Only) obtainable by installing the supplemental ventilation in the shelters designated by the NFSS. Nominal capacities may be doubled if desired. Two different policies control the use of this additional capacity: This PLAN B1 aims chiefly at better protection; so space allowance is minimized and Category 1 protection is abandoned where possible. The other PLAN B2 aims chiefly at better habitability, better living conditions and especially more space per shelteree. Shelters with Category 1 protection are still used, but shelters are occupied at nominal capacities as feasible.

Since no new construction in areas wanting in shelter is allowed in either PLAN B, no specifications can be given for the maximum allowable time or distance to shelter, or the minimum protection to be utilized. Water shielding is ignored.

Various supplements (trenches, creeks, mines) could be brought in here as necessary as part of increased emergency-readiness in response to threatening international relations.

Available Protective Resources

The new and different protection available for this PLAN in San Jose (Hypothetical) is:

1. The NFSS Shelters, both above and belowground, with added ventilation.
   Shown on Figure 32. } These have a total nominal capacity of 117,721, PF Cat 2-8.
   Detailed in Table 6 ("Vent Added"). } Their emergency capacity is twice this or 235,442.

   Note that the capacity of the PF Category 2-8 Shelters when ventilation is added is almost as much as the PF Category 1-8 Shelters without added ventilation (used in the previous PLAN A). Thus in this PLAN B1 we should be able to substitute the superior PF Cat 2-8 space for much of the PF Cat 1 space used previously in PLAN A.

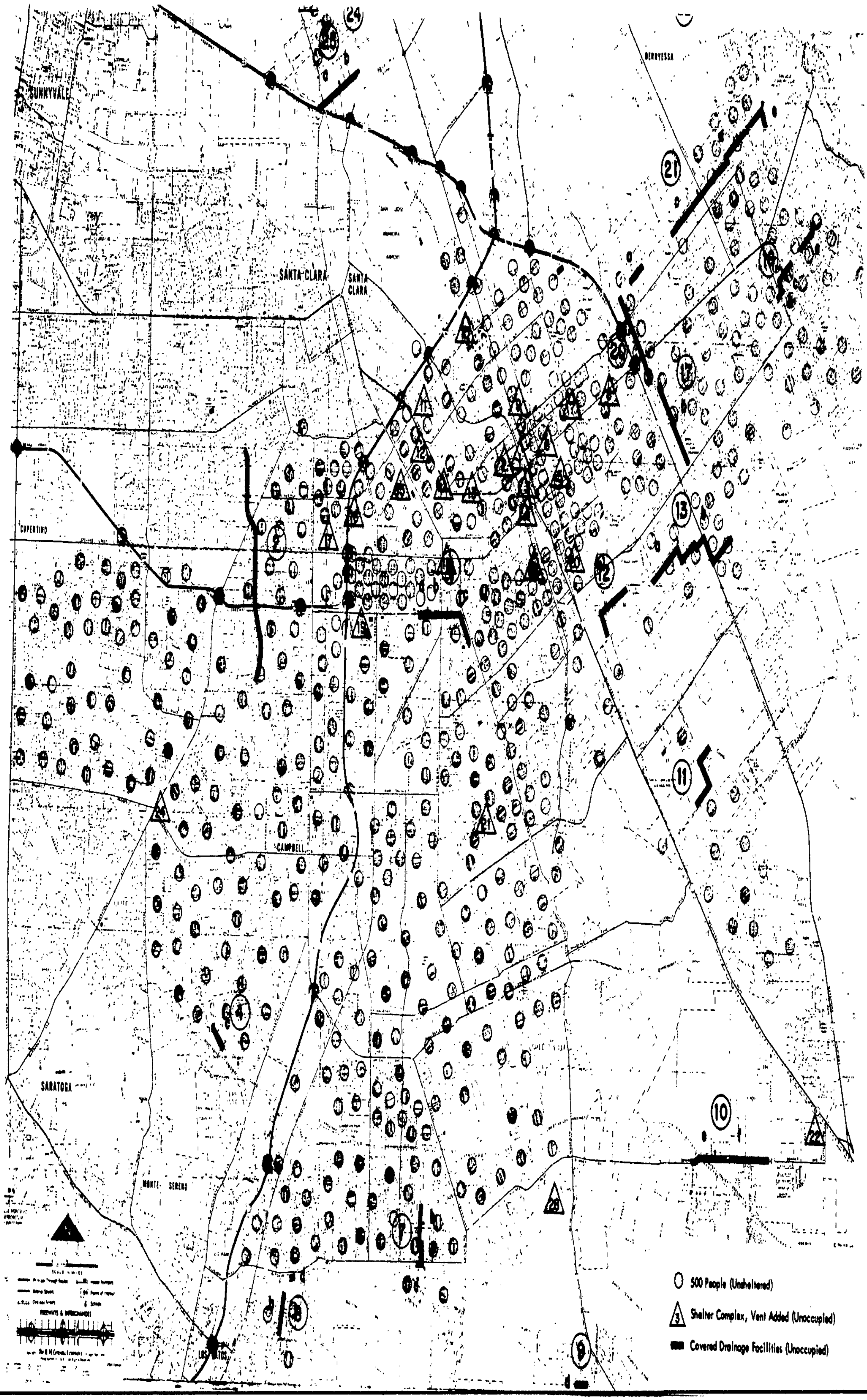
In addition we use again and without modification the PF Category 8 assets of PLAN A:

2. The Covered Drainage Facilities.
   Shown on Figure 19. } These have a total nominal capacity of 34,500.
   Detailed in Table 3. } Their emergency capacity is twice this or 69,000.

The Home Basements (assumed to be PF Category 1) of PLAN A are dropped from consideration here.

If the nominal capacities of the specified available resources were doubled, there would be emergency fallout shelter for some 304,442 people--roughly the size of the population to be protected. Hence their emergency shelter may be possible with little or no PF Category 1 space, and additional last-minute shelter/shielding through programs for increased emergency-readiness may not be needed.

The facing map relates these available protective resources to the resident distribution of population.


SUNNYVALE
BERRYESSA
SANTA CLARA
SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
500 People (Unsheltered)
Shelter Complex, Vent Added (Unoccupied)
Covered Drainage Facilities (Unoccupied)

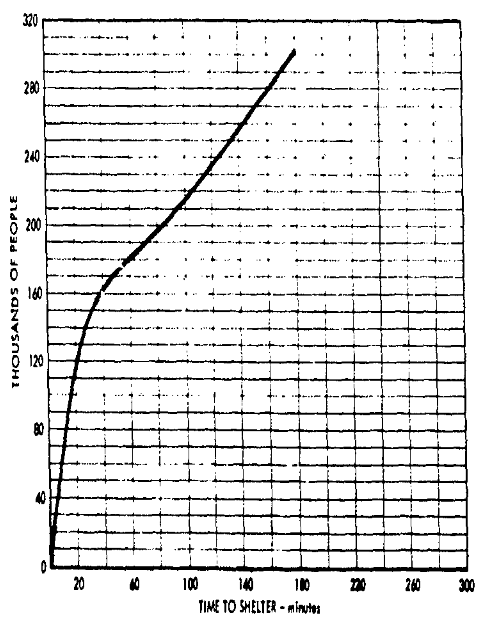
FALLOUT SHELTER IN NFSS SHELTERS (CAT ≥ 2) WITH ADDED VENTILATION, AND COVERED DRAINS (BOTH DOUBLED OCCUPANCY)

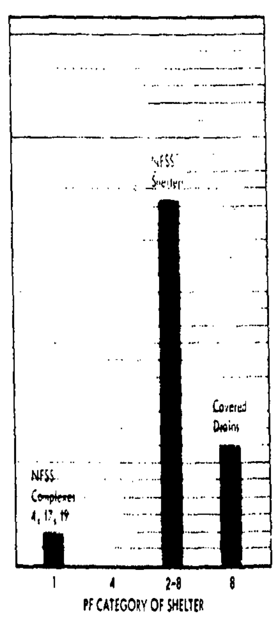
Comments

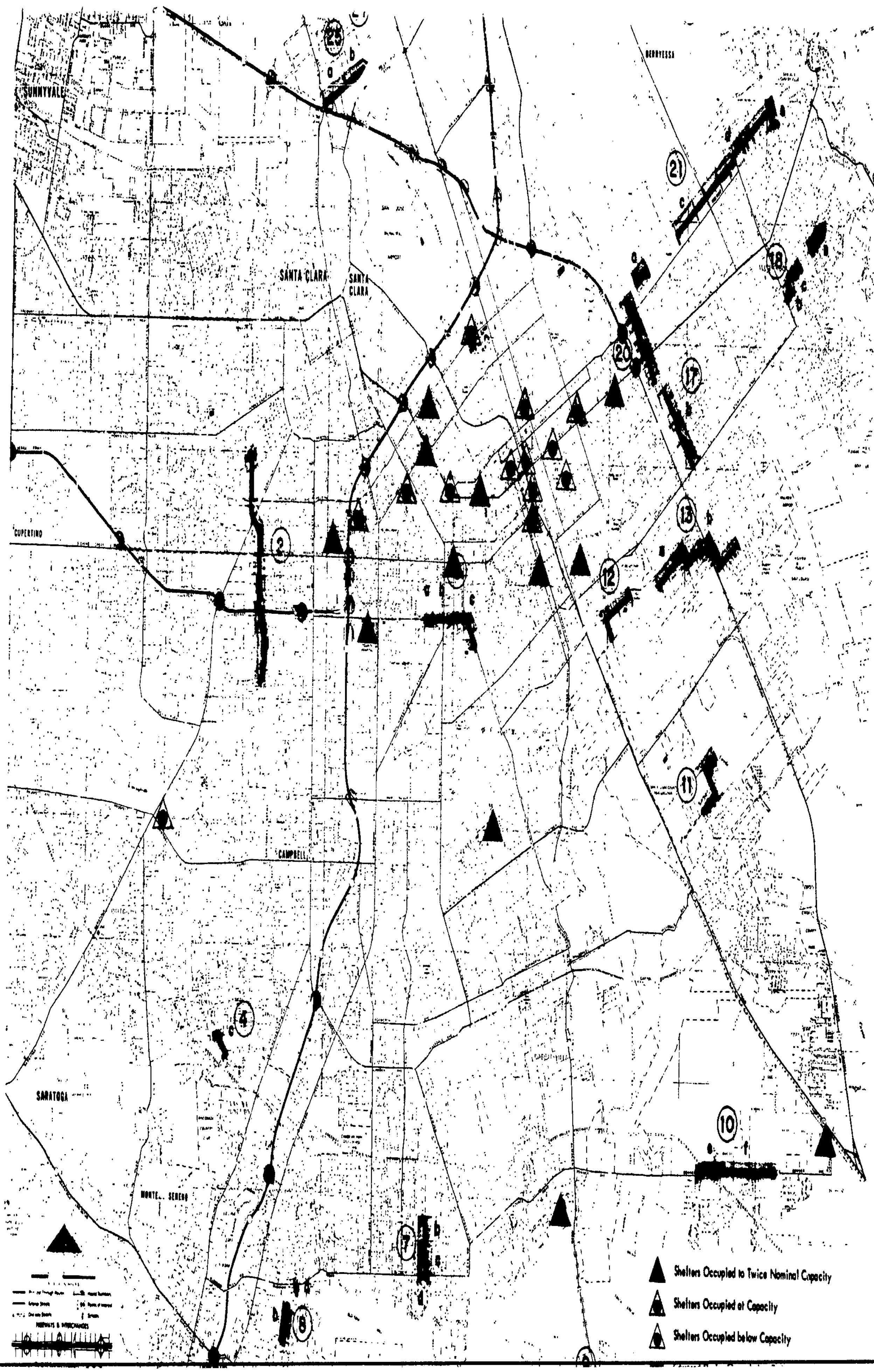
The facing map shows roughly how the facilities in this area-wide shelter system would be utilized--for protection--if radioactive fallout was the one and only threat to San Jose. The Characteristic Curves below reveal the general nature of the protection of this PLAN B1. The time to shelter is very similar to PLAN A; no noticeable improvement occurs in this department. The real improvement is in the other curve, in the quality of protection when sheltered. The PF is raised. The number of people sheltered in the inferior PF Category 1 is reduced by 80,000, from about 100,000 (PLAN A) to 20,000 (this PLAN B1). While we tried to eliminate Category 1 from this PLAN, that effort was not completely successful. We still find it necessary to use PF Category 1 protection in Shelter Complexes 4, 17, 19 and 20.

To weigh the value of these PF improvements against the estimated cost of the added ventilation would require a detailed consideration of the actual Protection Factors of each Facility involved. (While we have not done this, it could be done.) We have left the NFSS Shelters within the PF Category range 2-8 lumped together. Individual Category values are known for each Facility and could be broken out to reveal the quantitative improvement in PF obtained by replacing Category 1 protection with Category 2-8 protection.

Characteristic Curves






SUNNYVALE
SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
BERRYESSA
Shelters Occupied to Twice Nominal Capacity
Shelters Occupied at Capacity
Shelters Occupied below Capacity

PLAN B2--FALLOUT-ONLY REGION--IMPROVED STATUS QUO FOR BETTER HABITABILITY

Plan Definition

Take the protective resources of PLAN A and add to them the shelter spaces in San Jose (Fallout Only) obtainable by installing the supplemental ventilation in the shelters designated by the NFSS. Nominal capacities may be doubled if desired. Two different policies control the use of this additional capacity: This PLAN B2 aims chiefly at better habitability--more space per shelteree--so shelters with inferior protection are still used, and nominal occupancy of shelters is provided as feasible. The previous PLAN B1 aimed chiefly at better protection; so emergency high density occupancy was maintained and Category 1 protection abandoned insofar as possible.

Since no new construction in areas wanting in shelter is allowed in PLANS B1 or B2, no specifications can be given for the maximum allowable time or distance to shelter, or the minimum protection to be utilized. Water shielding is ignored.

Various supplements (trenches, creeks, mines) could be brought in here as necessary as part of increased emergency-readiness in response to threatening international relations.

Available Protective Resources

The following assets of San Jose (Fallout Only) are available:

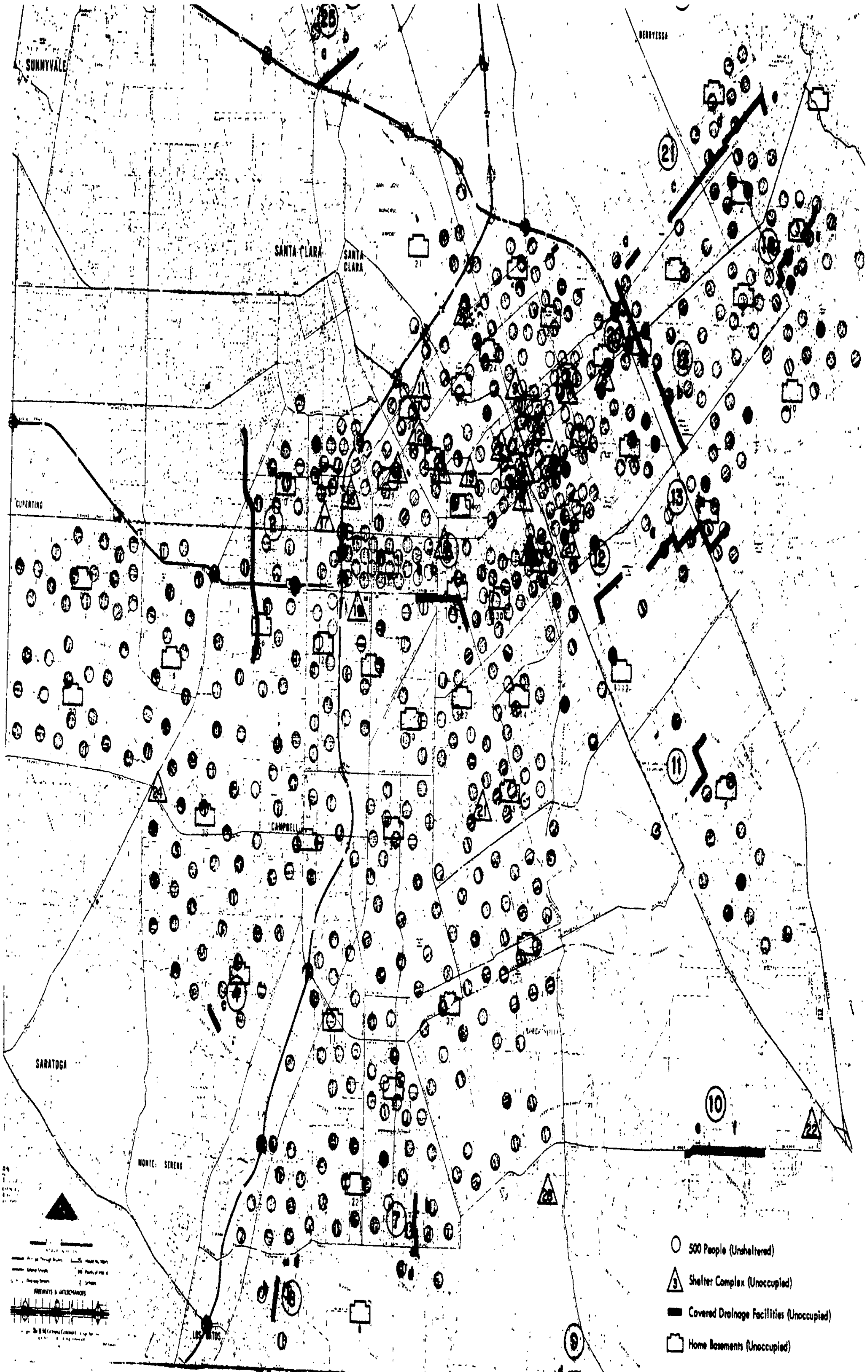
1. The NFSS Shelters, above and belowground, with added ventilation.
   Shown on Figures 32 and 33. These have a total nominal capacity of 191,329, PF Cat 1-8.
   Detailed in Table 6 ("Vent Added"). That nominal capacity will not be exceeded in this PLAN.

2. The Covered Drainage Facilities.
   Shown on Figure 19. These have a total nominal capacity of 34,500.
   Detailed in Table 3. Their emergency capacity for doubled occupancy is 69,000.

3. The Home Basements.
   Shown on Figure 27.
   Estimated to have a total nominal capacity of about 60,000 @ 3 per dwelling unit.
   Their emergency capacity for doubled occupancy is 120,000.

If all the maximum emergency occupancy listed above were used, the total capacity would be 380,329--somewhat more than the population to be protected. Thus it seems likely that the use of reduced space per person in Home Basements and Covered Drainage Facilities can be minimized in the interests of better habitability; and additional last-minute shelter/shielding through programs for increased emergency-readiness may not be needed.

The map on the facing page relates these available protective resources to the resident population.

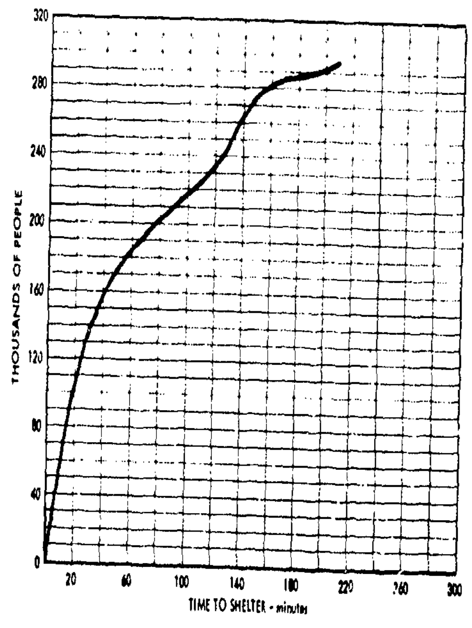

SUNNYVALE
SANTA CLARA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
500 People (Unsheltered)
Shelter Complex (Unoccupied)
Covered Drainage Facilities (Unoccupied)
Home Basements (Unoccupied)

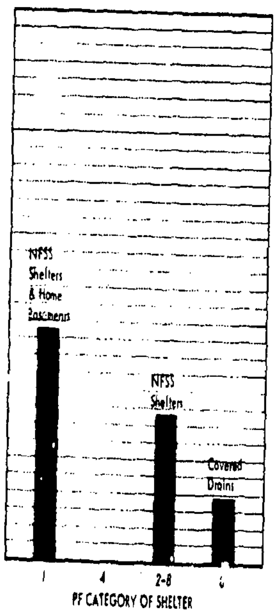
NFSS SHELTERS (CAT ≥ 1) VENT ADDED (NOMINAL CAPACITY), COVERED DRAINS (DOUBLED) AND HOME BASEMENTS (DOUBLED)

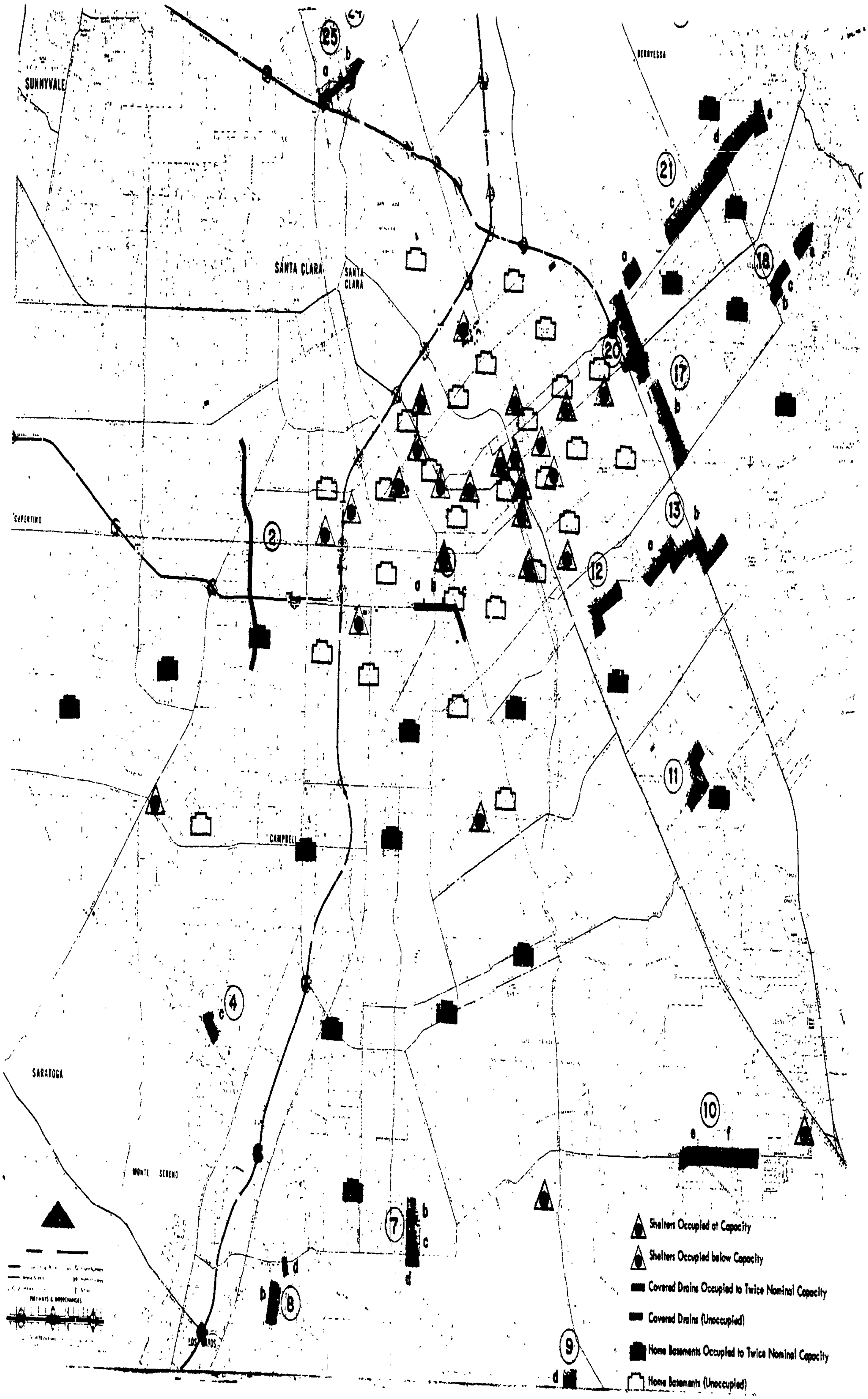
Comments

If radioactive fallout were the only threat to San Jose, protection might be sought with PLAN B2, represented by the facing map and the Characteristic Curves below. The time-to-shelter curve is similar to PLANS A and B1 (*since many of the same facilities are used*). The principal difference lies elsewhere. Living conditions have been improved by "maximizing" the use of NFSS Shelters and avoiding reduced space allowance therein; and "minimizing" the use of Covered Drainage and Home Basements, but doubling their occupancy where necessary. While more space per person results and that space is more habitable, the general quality of protection falls off and is inferior to both B1 and A.

Characteristic Curves






SUNNYVALE
SANTA CLARA
BERRYESSA
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
Shelters Occupied at Capacity
Shelters Occupied below Capacity
Covered Drains Occupied to Twice Nominal Capacity
Covered Drains (Unoccupied)
Home Basements Occupied to Twice Nominal Capacity
Home Basements (Unoccupied)

PLAN C--FALLOUT-ONLY REGION--COMPLETE FALLOUT PROTECTION

Plan Definition

All existing NFSS shelters in San Jose (Fallout Only) are screened to eliminate (1) times to shelter in excess of 30 minutes, (2) Protection Factors less than 40, (3) floor space less than 10 sq ft/person, and (4) poor habitability. The PLAN B shelters which are up to standards and survive this evaluation then serve as the base for building PLAN C. PLAN C adds to these acceptable PLAN B shelters the new construction fallout shelter necessary to protect the remaining unsheltered population. The new shelters must also meet the 30 minute, PF 40 or greater, and nominal occupancy standards. While the new fallout shelters could, in principle, be located any place (sufficiently near their future occupants), it is convenient to have them built on the existing public school grounds and parks in regions with shelter deficits.

Available Protective Resources

PLAN C starts with:

1. The NFSS Shelters (PF Cat 2-8), above and belowground, without added ventilation.
   Shown on Figure 32.
   Detailed in Table 6 ("As Is").

   These have a total nominal capacity of 57,981; but since they will be used only out to 30 minutes time-to-shelter, it is difficult to predict the number of spaces that will actually be used. Occupying densities beyond nominal capacities are not to be considered (no reduced space allowance).

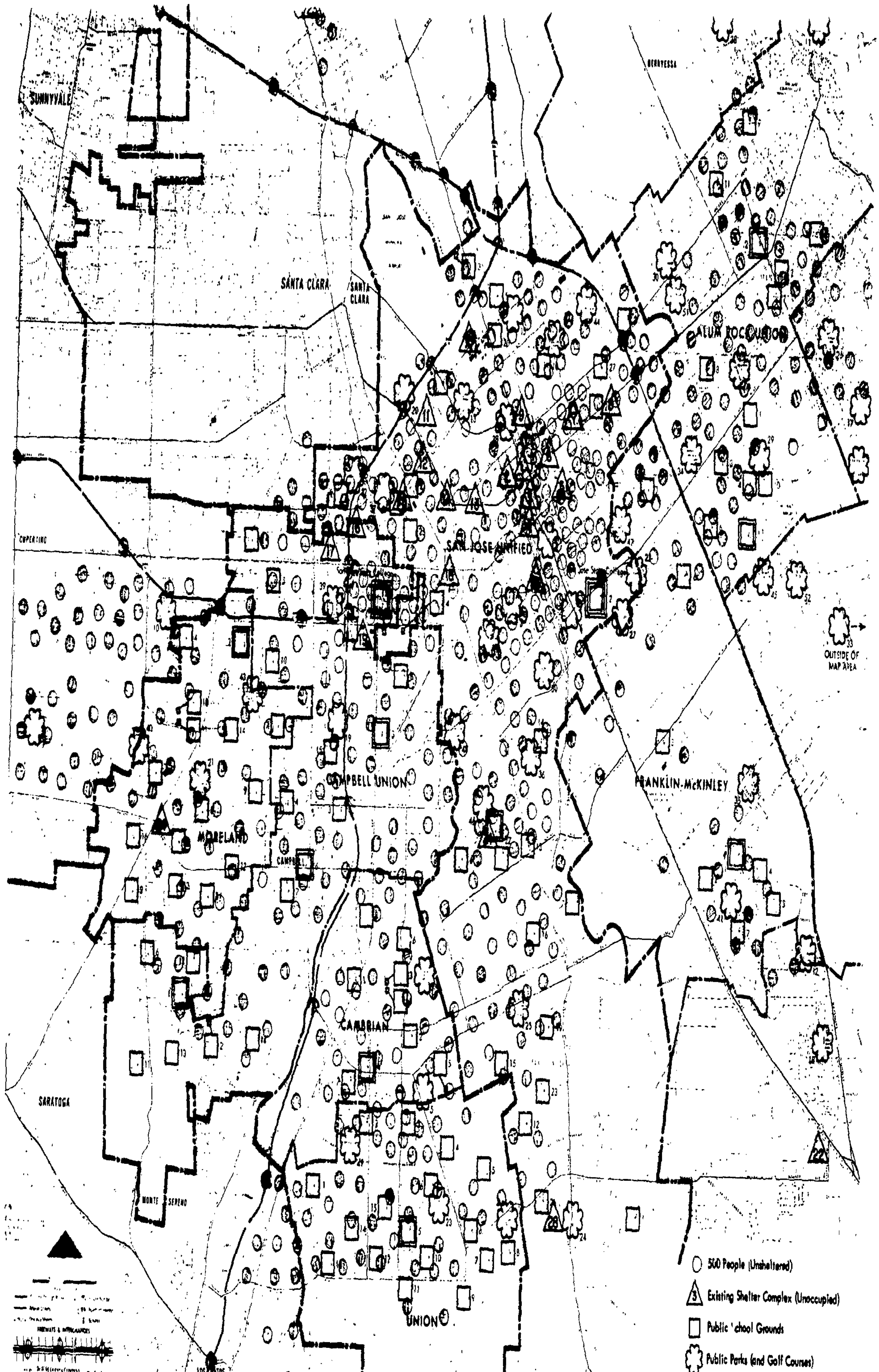
To this we add new fallout shelters to be constructed as required on:

2. Selected Public School Grounds in San Jose.
   Shown on Figure 22.
   Detailed in Appendix E. } These have a nominal total capacity of 1,456,000.

3. Selected Public Parks (and Golf Courses) of San Jose.
   Shown on Figure 23.
   Detailed in Appendix F. } These have a nominal total capacity of 842,000.

The distribution of these assets relative to the resident population of San Jose is shown on the facing map.

Since this area-wide shelter system is "made to order" for the people of San Jose, it will take care of everyone, and no last-minute augmentation by trenches, etc., is necessary.



SUNNYVALE
SANTA CLARA
BERRYESSA
ALUM ROCK UNION
SAN JOSE UNIFIED
OUTSIDE OF MAP AREA
CUPERTINO
CAMPBELL UNION
FRANKLIN-McKINLEY
MORELAND
CAMBRIAN
SARATOGA
MONTE SERENO
UNION
LOS GATOS
500 People (Unsheltered)
Existing Shelter Complex (Unoccupied)
Public 'chool Grounds
Public Parks (and Golf Courses)

PROTECTION PROVIDED BY NFSS AND NEW FALLOUT SHELTERS UP TO MINIMUM STANDARDS

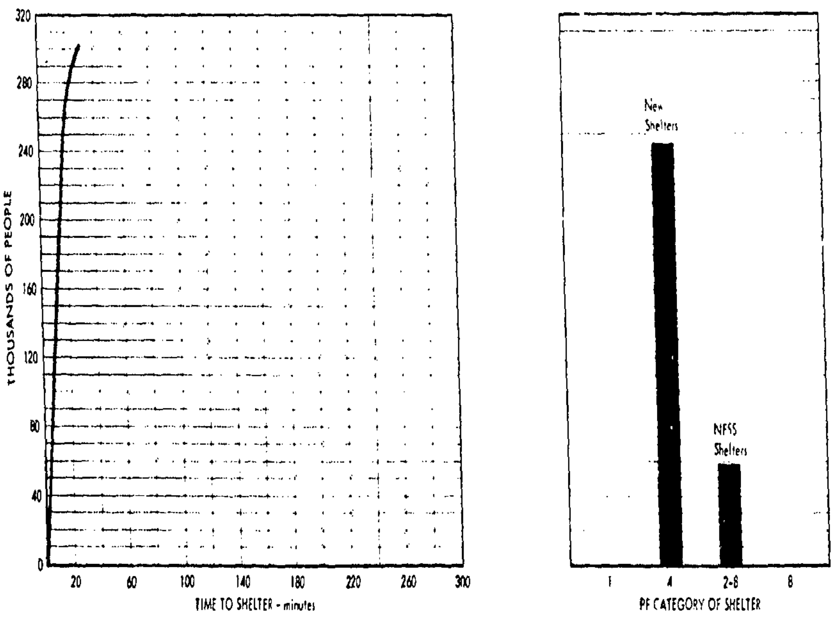
Comments

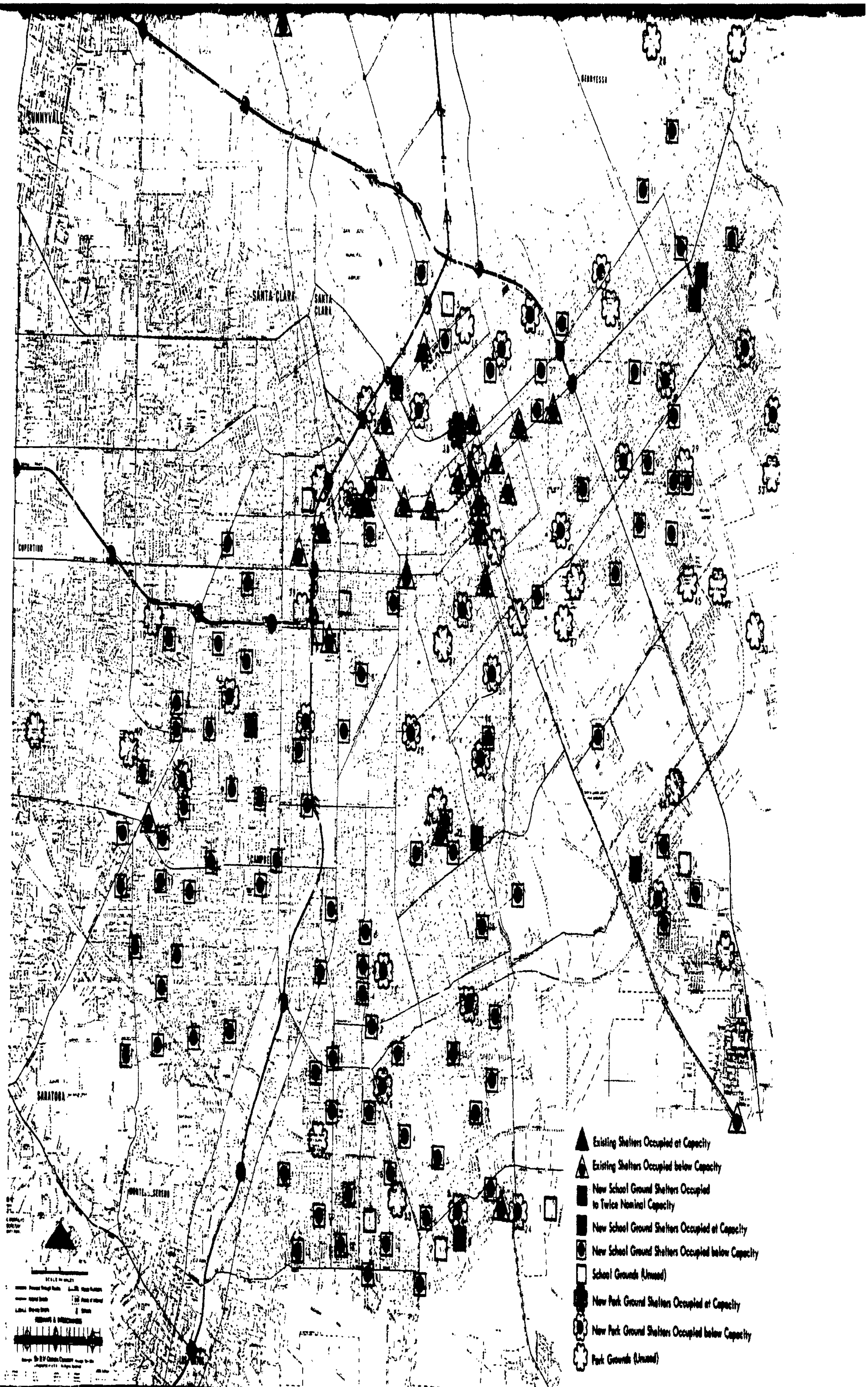
Here for the first time is a fallout shelter system designed and built to meet community needs for protection, assuming San Jose is threatened by nothing but radioactive fallout in the event of nuclear attack. The facing map shows the approximate disposition of people after they are protected. The Characteristic Curves below reveal the essential features of this protective arrangement. All facilities are permanent, well-built structures; living conditions are as nearly normal as the situation seems to warrant.

The Characteristic Curves show everything to be in order. Everybody is within 30 minutes (or 1 mile) of shelter, and about half the population is no farther away than 10 minutes. The protection from the existing NFSS Shelters is at least PF Category 2 and from the new construction is (at least) PF Category 4.

Although the loading of the existing NFSS Shelters was limited to just the people within 1 mile, practically all of that protective space was used. Table 11 at the end of this section shows the loading of the NFSS Shelter Complexes. All but one are filled to capacity with people no farther away than 1 mile. This suggests that more capacity could probably have been used in some of those existing shelters. Thus, an important alternative would be a "PLAN C" using the larger capacities for the NFSS Shelter Complexes made possible by adding ventilation to specified basements. It appears likely that at least in some cases, additional capacity could be used in existing facilities (through more basement ventilation) thereby reducing the number of spaces requiring completely new shelter construction. This procedure could conceivably reduce the 243,940 new shelter spaces shown here by as much as 60,000 (since some 60,000 spaces were gained by supplementary ventilation). This would still mean that most of the shelter for complete fallout protection for San Jose (Fallout Only) would have to be newly built--to get an area-wide shelter system up to minimum standards.

Characteristic Curves





SUNNYVALE
SANTA CLARA
SANTA CLARA
CUPERTINO
SARATOGA
BERRYESSA
Existing Shelters Occupied at Capacity
Existing Shelters Occupied below Capacity
New School Ground Shelters Occupied to Twice Nominal Capacity
New School Ground Shelters Occupied at Capacity
New School Ground Shelters Occupied below Capacity
School Grounds (Unused)
New Park Ground Shelters Occupied at Capacity
New Park Ground Shelters Occupied below Capacity
Park Grounds (Unused)

Table 10

THE USE OF PUBLIC SCHOOL GROUNDS AND PARKS AS SITES FOR NEW FALLOUT SHELTERS FOR PLAN C

COLLEGIATE FIELDS

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	56,000	0	0	0		0
2	132,400	500	1,625	1,875		4,000
	Total	500	1,625	1,875		4,000

CAMPBELL ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	23,000	0	0			0
2	2,600	1,500	500			2,000
3	3,200	500	0			500
4	5,000	1,750	800			2,550
5	7,000	1,250	1,000			2,250
6	6,600	1,000	0			1,000
7	12,900	1,000	0			1,000
8	10,500	750	0			750
9	7,150	500	500			1,000
10	11,000	1,000	500	1,000		2,500
11	3,680	500	500			1,000
12	9,520	1,000	500			1,500
13	2,000	0	500			500
14	8,000	1,000	750			1,750
15	7,000	1,250	1,250			2,500
	Total	13,000	6,800	1,000		20,800

SAN JOSE UNIFIED

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	1,260	0	0	0	0	0
2	5,760	1,500	250	250	250	2,250
3	8,250	1,250	0	0	1,000	2,250
4	9,520	2,000	2,500	240	0	4,740
5	1,280	0	0	0	0	0
6	7,430	1,000	1,750	1,000	0	3,750
7	4,380	250	875	0	0	1,125
8	1,380	1,125	125	0	0	1,250
9	2,410	0	0	0	0	0
10	1,845	1,000	0	0	0	1,000
11	9,380	0	0	0	0	0
12	15,150	1,000	0	0	0	1,000
13	1,660	1,500	250	0	0	1,750
14	7,090	1,000	0	500	0	1,500

SAN JOSE UNIFIED (Continued)

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
15	1,920	1,000	625	0	0	1,625
16	7,557	1,625	500	0		2,125
17	-	-	-	-		-
18	2,250	2,000	0	0		2,000
19	5,645	1,000	0	125		1,125
20	10,190	250	2,250	0		2,500
21	21,600	1,125	1,000	1,000		3,125
22	58,000	2,868	1,875	375		5,118
23	9,200	375	1,625	375		2,375
24	10,700	1,950	0	0		1,950
25	29,600	1,000	0	0	0	1,000
26	68,000	0	825	0		825
27	17,500	500	375	500		1,375
	Total	25,250	14,825	4,365	1,250	45,690

CAMPBELL UNION HIGH SCHOOL

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	66,000	500	0			500
2	65,000	0	750			750
3	48,000	2,000	500	500		3,000
4	24,144	1,000	0			1,000
5	55,500	0	0			0
6	22,500	2,000	250			2,250
	Total	5,500	1,500	500		7,500

MORELAND ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	0	0	0			0
2	9,100	500	500			1,000
3	4,500	1,000	500			1,500
4	9,000	1,000	2,500			3,500
5	19,400	700	0			700
6	6,200	1,000	250			1,250
7	880	1,000	0			1,000
8	2,000	1,250	0			1,250
9	4,000	900	500			1,400
10	3,800	500	0			500
11	24,000	1,000	0			1,000
12	5,700	600	500			1,100

TABLE 10 (Continued)

MORELAND ELEMENTARY (Continued)

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
13	4,800	600	750			1,350
14	4,800	800	0			800
15	-	-	-			-
16	6,050	500	500			1,000
	Total	11,350	6,000			17,350

CAMBRIAN ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	3,140	1,250	1,300			2,550
2	11,950	1,200	500			1,700
3	21,600	250	0			250
4	3,760	750	0			750
5	5,600	750	500			1,250
6	5,610	1,000	2,250			3,250
7	3,840	1,250	1,250			2,500
8	4,150	1,000	1,000	1,000		3,000
	Total	7,450	6,800	1,000		15,250

UNION ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	5,068	1,250	2,000			3,256
2	5,040	1,600	1,000			2,600
3	8,840	2,300	1,500			3,800
4	11,200	750	500			1,250
5	18,000	500	0			500
6	10,600	1,000	0	-		1,000
7	15,200	0	0	-		0
8	280	500	0	-		500
9	12,600	500	500	-		1,000
10	13,100	1,250	0	-		1,250
11	3,000	750	0	-		750
12	9,400	1,250	0	-		1,250
13	7,200	1,500	600	1,500		3,600
14	23,200	600	0	-		600
15	9,740	700	200	-		900
16	3,370	800	800	-		1,600
	Total	15,250	7,100	1,500		23,850

ALUM ROCK UNION HIGH SCHOOL

SCHOOL NO.	CAPACITY	INCREMENTAL OCCUPANCY (MINUTES) 0-10	10-20	20-30	30-40	TOTAL
1	62,500	1,500	500	-		2,000
2	42,500	1,200	2,000	-		3,200

ALUM ROCK ELEMENTARY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	13,500	1,250	1,250	-		2,500
2	3,600	1,250	2,500	-		3,750
3	2,750	1,250	0	-		1,250
4	37,000	1,000	0	-		1,000
5	10,600	1,500	1,000	-		2,500
6	11,000	2,300	500	-		2,800
7	1,500	1,500	0	-		1,500
8	32,000	1,250	1,500	-		3,750
9	6,000	1,500	3,000	-		4,500
10	27,000	0	500	-		500
11	9,000	1,500	1,000	-		2,500
	Total	17,000	13,750	0		30,750

FRANKLIN McKINLEY

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	7,210	2,000	1,000	0		3,000
2	1,260	250	500	500		1,250
3	6,700	0	500	1,000		1,500
4	16,000	0	0	0		0
5	3,920	500	1,000	500		2,000
6	3,350	1,500	1,000	500		3,000
7	4,050	1,000	0	0		1,000
8	-	-	-	-		-
9	16,600	700	500	0		1,200
	Total	5,950	4,500	2,500		12,950

PARKS

SCHOOL NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
1	0	-	-	-		-
2	8,500	0	-	-		0
3	7,800	750	0	2,500		3,250
4	19,000	1,250	0	0		1,250
5	3,200	250	0	0		250
6	0	-	-	-		-

TABLE 10 (Continued)

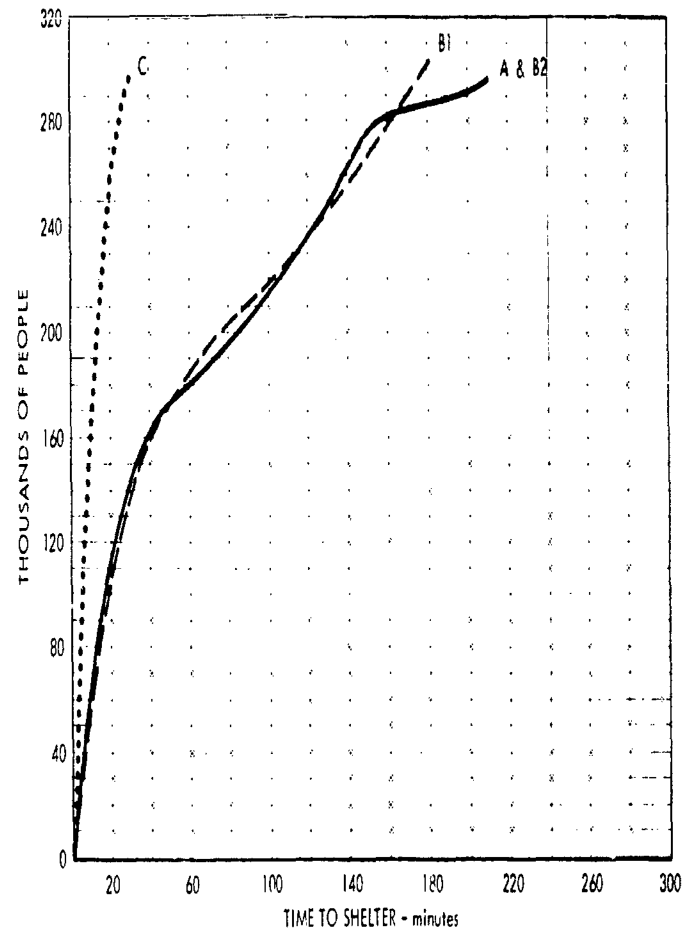
PARKS (Continued)		INCREMENTAL OCCUPANCY (MINUTES)				
NO.	CAPACITY	0-10	10-20	20-30	30-40	TOTAL
7	8,700	-	-	-		-
8	10,000	-	-			-
9	10,000	1,750	0	-		1,750
10	8,400	-	-	-		-
11	0	-	-	-		-
12	0	-	-	-		-
13	7,600	500	0	0		500
14	6,100	1,000	0	0		1,000
15	500	0	0	0		0
16	0	-	-	-		-
17	-	500	-	-		500
18	-	-	-	-		-
19	4,500	1,500	1,500	-		3,000
20	0	-	-	-		-
21	6,100	500	0	-		500
22	44,000	-	-	-		-
23	-	-	-	-		-
24	-	500	0	0		500
25	-	2,000	1,500	1,000		4,500
26	-	1,500	1,500	0		3,000
27	-	-	-	-		-
28	-	-	-	-		-
29	-	-	-	-		-
30	-	500	0	0		500
31	0	-	-	-		-
32	0	-	-	-		-
33	-	-	-	-		-
34	-	1,500	0	0		1,500
35	-	-	-	-		-
36	8,800	1,750	2,500	500		4,750
37	3,800	0	0	2,500		2,500
38	500	500	0	0		500
39	6,700	0	0	-		0
40	500	-	-	-		0
41	-	250	0	0		250
42	0	-	-	-		-
43	4,700	700	500	0		1,200
44	25,400	1,250	-	-		1,250
45	5,800	-	-	-		-
46	0	-	-	-		-
47	22,000	2,250	4,000	0		6,250
48	7,400	2,125	0	1,125		3,250
49	378,000	-	-	-		-
50	24,000	500	3,000	3,500		7,000
	Total	23,325	14,500	11,125.		48,950

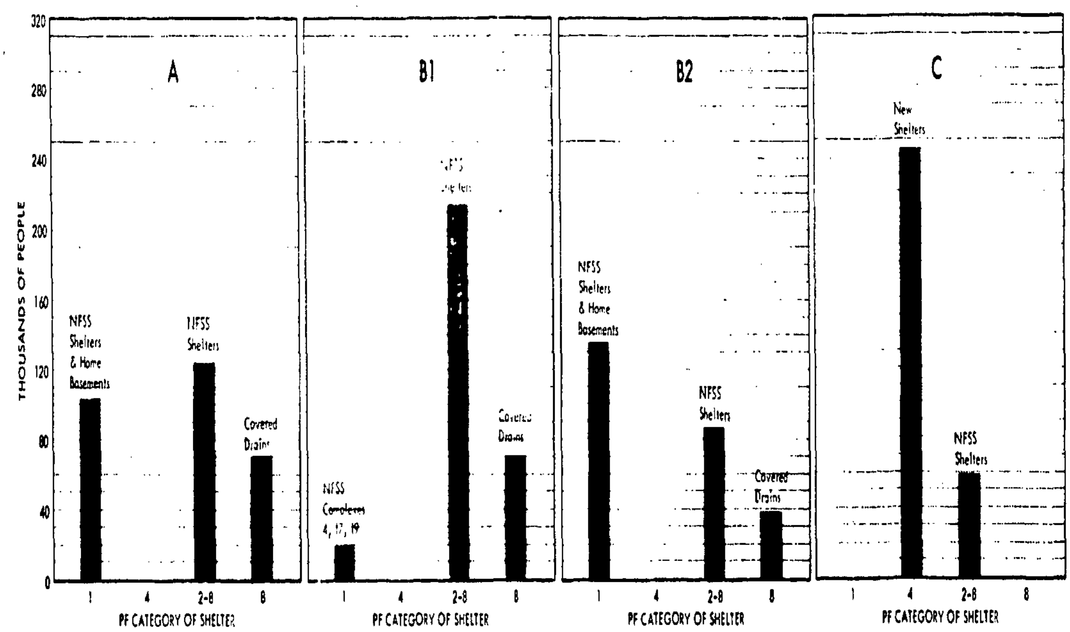
Table 11

THE USE OF NFSS SHELTER COMPLEXES FOR FALLOUT SHELTER UP TO MINIMUM STANDARDS FOR PLAN C

COMPLEXES		INCREMENTAL OCCUPANCY (MINUTES)			
NO.	CAPACITY	0-10	10-20	20-30	TOTAL
1	12,698	1,500	3,500	6,000	11,000
2	459	459	-	-	459
3	3,027	2,000	1,027	-	3,027
4	4,224	1,500	2,724	-	4,224
5	1,740	1,740	-	-	1,740
6	986	986	-	-	986
7	506	506	-	-	506
8	300	300	-	-	300
9	393	393	-	-	393
10	5,229	750	3,979	500	5,229
11	121	121	-	-	121
12	134	134	-	-	134
13	949	949	-	-	949
14	412	412	-	-	412
15	70	70	-	-	70
16	1,328	0	1,328	-	1,328
17	12,834	1,034	7,000	4,800	12,834
18	260	260	-	-	260
19	3,197	1,500	1,750	-	3,250
21	132	132	-	-	132
22	812	0	0	500	500
23	6,945	4,000	2,945	-	6,945
24	2,756	1,000	1,250	506	2,756
26	225	225	-	-	225
28	647	647	-	-	647
	Total	20,618	25,503	12,306	58,427

SUMMARY OF CHARACTERISTIC CURVES OF AREA-WIDE SHELTER SYSTEMS FOR SAN JOSE AS A FALLOUT-ONLY REGION





APPENDIXES

APPENDIX A

NFSS SHELTERS IN SAN JOSE AND BASEMENT SHELTERS IN PARTICULAR

Master List of NFSS Shelter Capacities

The locations of NFSS Basement Shelters in San Jose are shown in the body of this report in Figures 17 and 46 (downtown only), and their capacities appear in Table 2. Likewise the locations of NFSS Shelters, above and belowground, are shown in Figures 32 (PF $\geq$ 40) and 33 (PF 20-40); and their detailed distributions downtown are in Figures 47 and 48. Table 6 gives their capacities--also in the body of this report. These NFSS shelter data were obtained from our Master List of shelter capacities which follows as Table A-1 in this appendix.

Summary Totals of NFSS Shelter Capacities

Following Table A-1, there appear in Table A-2 the summary totals for NFSS shelter capacities of interest to San Jose. At least two features of these tabulations are noteworthy: (1) the considerable inventory of Category 1 (PF 20-40) low grade spaces, and (2) the sizable increase in capacity which can be obtained by adding ventilation to some of the basement shelters.

Shelter Capacity Increases Potentially Possible with Added Ventilation

Table A-3 reviews the benefits (for added shelter capacities) of supplementing the existing basement ventilation with additional equipment for bringing fresh air into the occupants.

Inspection of Sample NFSS Basement Shelters for Possible Upgrading

As explained in the body of this report, the reinforced-concrete basements among the NFSS shelters have the best potential for passive protection against direct effects of all the spaces in existing buildings of conventional construction. However, to serve usefully in Direct-Effects Regions the NFSS Basement Shelters must be upgraded against mass fire and blast. Procedures for such upgrading have been outlined elsewhere.* Our purpose here is to evaluate the suitability of NFSS Basement Shelters in San Jose for such upgrading.

There are some 83 basements in San Jose which have been identified by the NFSS for consideration as shelter. It was not feasible for members of this study team to visit all of those facilities and evaluate their possible upgrading. So a smaller number of basement facilities was taken--a number that could be inspected--and by careful selection, that smaller number was made to represent a majority of the available NFSS Basement Shelter space. As shown in Table A-4, eighteen San Jose basements were investigated. And those eighteen contain 65% of the total basement capacity "as is"; 55% of the basement spaces nominated by the NFSS for supplemental ventilation; and 59% of the total basement capacity when additional ventilation is included. Thus the results of the inspections are significant

* Richard I. Condit, Concepts for Upgrading the Protection of Identified Fallout Shelters in Basements, Stanford Research Institute for the Office of Civil Defense, October 1965.

for the total NFSS Basement Shelter capacity of San Jose. Of the 18 basements surveyed:

1. All can be upgraded structurally, at least on a temporary basis.

2. An internal fire hazard presently exists in the following, making them unsuitable for upgrading:

FACILITY NUMBER	NFSS CAPACITIES AS IS	VENT ADDED	TOTAL
53	364	0	364
70	704	1,589	2,293
108	1,971	0	1,971
147 (Complex 8)	**300**	**750**	**1,050**
175 (Complex 24)	**2,756**	**0**	**2,756**
209	288	180	468
TOTAL LOSS	6,384	2,519	8,903

All of these except 147 and 175 are also located within the potential firestorm area of San Jose--so they are eliminated from consideration for upgrading on two counts. Facilities 147 and 175 are outside the potential firestorm area, so their loss is new and due solely to their own internal condition. Their aggregate capacities are 3,056 (As Is), 750 (Vent Added), and 3806 (Total with Vent Added).

A detailed check list summary of the results of the inspections of the 18 selected NFSS Basement Shelters in San Jose is given as Table A-5. That table is based on a particular conception of a "normal" reinforced-concrete basement. Insofar as the basement being inspected corresponded to that preconception, its features could be checked off as in agreement. Where the given basement departed from "the standard" it was given an "X" or a number. The "X" signifies an exception, a non conformity; the numbers refer to explanatory notes which follow the table. Thus the inspections were recorded principally on the basis of exceptions from a preconceived standard. The summary Table A-5 has several noteworthy features which have not yet been pointed out:

1. (Under K in Table A-5.) It was the opinion of the inspecting teams that the structural integrity of the particular NFSS Basement Shelters examined would not be destroyed by the general community fire expected to develop postattack. So, if the basement managed to survive the initial blast in a useful condition, that condition was not expected to be additionally degraded by postattack fire effects. This is an interesting opinion, because (if true) it means that these shelters may be usable after the postattack fire burns itself out. While mass fire effects are expected to drive people out of the existing NFSS Basement Shelters (not upgraded against blast and fire), those evacuees may find it profitable to return to the remaining burned-out basement shelters at some later time, after the general fire has subsided. While the basement contents (including stocked shelter supplies) may be consumed or rendered worthless by fire in shelter, the protective shielding provided by the basement may still be as effective as ever. And once a given basement shelter and its surroundings have been burned out, the major threat from fire is removed. For fires cannot generally reduce a region more than once. After the postattack fire, basement shelters in the burned-out area which remain usable will offer Universal Protection--and for the first time.

2. (Under L.2 in Table A-5.) Furnishings to allow high-density occupancy cannot be applied generally to the NFSS Basement Shelters inspected. Those furnishings tend to be incompatible with present basement uses. Basements now serving for offices, merchandising and display cannot tolerate arrays of multitier living platforms or bunks. And basement hallways and corridors must normally be kept clear; so furnishings to be considered for such shelter spaces should be readily collapsible, or should swing up or out of the way into concealed storage overhead or in the sidewalls. Only when the basement is largely empty and unused, or utilized for certain kinds of warehousing or storage is there a reasonable chance that existing designs for multitier living or sleeping can be utilized.

Table A-1

MASTER LIST OF NFSS SHELTER CAPACITIES FOR SAN JOSE

	FACILITY		ABOVE		BELOW			ABOVE & BELOW		
COMPLEX	LIC.	UNLIC.	CAT 1	CAT 2-8	CAT 1	CAT 2-8	VENT ADDED*	CAT 1	CAT 2-8	CAT 2-8 (W/VENT ADDED)
1	45		0	0	0	497	745	0	497	1,242
	53		0	0	0	364	0	0	364	364
		63	750	73	0	85	455	750	158	613
	70		0	0	0	704	1,589	0	704	2,293
	73		1,029	1,347	0	236	818	1,029	1,583	2,401
		74	0	0	/**	332	0	0	332	332
		75	0	0	0	54	176	0	54	230
	84		959	0	0	0	0	959	0	0
	85		0	1,320	0	50	200	0	1,370	1,570
	116		1,324	2,842	0	400	1,141	1,324	3,242	4,383
	120		350	1,800	0	178	632	350	1,978	2,610
	121		1,708	170	0	136	408	1,708	306	714
		122	0	0	/	88	463	0	88	551
	129		0	0	0	92	203	0	92	295
		130	173	0	0	119	193	173	119	312
		132	144	138	0	0	0	144	138	138
	138		750	518	0	/	53	750	518	571
	205		2,160	0	0	1,155	0	2,160	1,155	1,155
TOTAL			9,347	8,208	0	4,490	7,076	9,347	12,698	19,774
TOTAL LICENSED			8,280	7,997	0	3,812	5,789	7,674	11,809	17,598
TOTAL UNLICENSED			1,067	211	0	678	1,287	1,673	889	2,176
GRAND TOTAL			9,347	8,208	0	4,490	7,076	9,347	12,698	19,774
2	72		2,592	0	0	206	646	2,592	206	852
		77	0	0	0	138	346	0	138	484
		78	0	0	55	0	-***	55	0	0
		82	0	0	77	0	-	77	0	0
	83		0	0	0	115	366	0	115	481
TOTAL			2,592	0	132	459	1,358	2,724	459	1,871
TOTAL LICENSED			2,592	0	0	321	1,012	2,592	321	1,333
TOTAL UNLICENSED			0	0	132	138	346	132	138	484
GRAND TOTAL			2,592	0	132	459	1,358	2,724	459	1,871

TABLE A-1 (Continued)

COMPLEX	FACILITY LIC.	FACILITY UNLIC.	ABOVE CAT 1	ABOVE CAT 2-8	BELOW CAT 1	BELOW CAT 2-8	BELOW VENT ADDED*	ABOVE & BELOW CAT 1	ABOVE & BELOW CAT 2-8	ABOVE & BELOW CAT 2-8 (W/VENT ADDED)
3		48	292	366	0	84	442	292	450	892
		50	390	0	0	101	391	390	101	492
	51		1,380	0	0	173	551	1,380	173	724
	58		0	0	50	0	-	50	0	0
		87	168	0	0	/	0	168	0	0
	88		1,592	598	0	286	1,148	1,592	884	2,032
		93	810	405	0	131	598	810	536	1,134
	97		0	0	/	280	1,002	0	280	1,282
		100	0	0	0	95	431	0	95	526
	207		70	0	0	64	0	70	64	64
		208	339	0	0	98	396	339	98	494
	209		0	0	0	288	180	0	288	468
		211	531	0	0	58	0	531	58	58
TOTAL			5,572	1,369	50	1,658	5,139	5,622	3,027	8,166
TOTAL LICENSED			3,042	598	50	1,091	2,881	3,092	1,689	4,570
TOTAL UNLICENSED			2,530	771	0	567	2,258	2,530	1,338	3,596
GRAND TOTAL			5,572	1,369	50	1,658	5,139	5,622	3,027	8,166
4		59	637	0	/	0	-	637	0	0
	65		450	0	0	345	1,383	450	345	1,728
	66		627	0	0	129	331	627	129	460
		71	0	0	74	0	-	74	0	0
	108		1,314	0	0	1,971	0	1,314	1,971	1,971
	204		360	0	0	359	0	360	359	359
		206	400	1,272	0	148	600	400	1,420	2,020
TOTAL			3,788	1,272	74	2,952	2,314	3,862	4,224	6,538
TOTAL LICENSED			2,751	0	0	2,804	1,714	2,751	2,804	4,518
TOTAL UNLICENSED			1,037	1,272	74	148	600	1,111	1,420	2,020
GRAND TOTAL			3,788	1,272	74	2,952	2,314	3,862	4,224	6,538
5	110		1,178	0	0	0	0	1,178	0	0
	112		1,452	0	0	0	0	1,452	0	0
	114		4,606	608	0	0	0	4,606	608	608
	115		8,000	0	0	0	0	8,000	0	0
	118		630	0	0	50	0	630	51	50
	119		855	569	0	513	1,026	855	1,082	2,108
TOTAL			16,721	1,177	0	563	1,026	16,721	1,740	2,766

TABLE A-1 (Continued)

	FACILITY		ABOVE		BELOW			ABOVE & BELOW		
COMPLEX	LIC.	UNLIC.	CAT 1	CAT 2-8	CAT 1	CAT 2-8	VENT ADDED*	CAT 1	CAT 2-8	CAT 2-8 (W/VENT ADDED)
6		103	270	270	0	162	0	270	432	432
		133	712	0	0	0	0	712	0	0
	134		1,175	470	0	84	340	1,175	554	894
TOTAL			2,157	740	0	246	340	2,157	986	1,326
TOTAL LICENSED			1,175	470	0	84	340	1,175	554	894
TOTAL UNLICENSED			982	270	0	162	0	982	432	432
GRAND TOTAL			2,157	740	0	246	340	2,157	986	1,326
7	146		175	0	217	506	0	392	506	506
8	147		0	0	0	300	750	0	300	1,050
9		10	360	0	0	0	0	360	0	0
	140		343	343	0	0	0	343	343	343
	187		0	0	0	50	0	0	50	50
TOTAL			703	343	0	50	0	703	393	393
TOTAL LICENSED			343	343	0	50	0	343	393	393
TOTAL UNLICENSED			360	0	0	0	0	360	0	0
GRAND TOTAL			703	343	0	50	0	703	393	393
10	1		60	0	0	0	0	60	0	0
	2		2,400	800	0	416	384	2,400	1,216	1,600
	3		0	0	0	200	254	0	200	454
	4		2,031	2,031	0	324	1,298	2,031	2,355	3,653
	6		2,688	0	0	193	1,017	2,688	193	1,210
	7		0	0	0	85	392	0	85	477
	8		1,200	0	0	322	1,023	1,200	322	1,345
	201		881	858	0	0	0	881	858	858
	224		1,552	0	0	0	0	1,552	0	0
		225	324	0	0	0	0	324	0	0
TOTAL			11,136	3,689	0	1,540	4,368	11,136	5,229	9,597
TOTAL LICENSED			10,812	3,689	0	1,540	4,368	10,812	5,229	9,597
TOTAL UNLICENSED			324	0	0	0	0	324	0	0
GRAND TOTAL			11,136	3,689	0	1,540	4,368	11,136	5,229	9,597

TABLE A-1 (Continued)

COMPLEX	FACILITY LIC.	FACILITY UNLIC.	ABOVE CAT 1	ABOVE CAT 2-8	BELOW CAT 1	BELOW CAT 2-8	BELOW VENT ADDED*	ABOVE & BELOW CAT 1	ABOVE & BELOW CAT 2-8	ABOVE & BELOW CAT 2-8 (W/VENT ADDED)
11	17		0	0	0	60	277	0	60	337
	18		0	0	0	61	245	0	61	306
		171	0	0	60	0	0	60	0	0
TOTAL			0	0	60	121	522	60	121	643
TOTAL LICENSED			0	0	0	121	522	0	121	643
TOTAL UNLICENSED			0	0	60	0	0	60	0	0
GRAND TOTAL			0	0	60	121	522	60	121	643
12	20		0	0	0	134	656	0	134	790
13	11		0	0	0	760	3,020	0	760	3,780
		89	0	189	0	0	0	0	189	189
14		38	1,750	0	0	106	234	1,750	106	340
	39		644	186	0	0	0	644	186	186
	40		0	0	52	0	-	52	0	0
	41		0	0	0	120	0	0	120	120
TOTAL			2,394	186	52	226	234	2,446	412	646
TOTAL LICENSED			644	186	52	120	0	698	412	306
TOTAL UNLICENSED			1,750	0	0	106	234	1,750	106	340
GRAND TOTAL			2,394	186	52	226	234	2,446	412	646
15	22		0	0	0	70	74	0	70	144
	23		0	0	182	0	-	182	0	0
TOTAL			0	0	182	70	74	182	70	144
16	26		4,553	0	0	1,328	2,128	4,553	1,328	3,456
17	173		3,805	3,805	0	8,814	20,568	3,805	12,619	33,187
		174	0	0	0	215	685	0	215	900

TABLE A-1 (Continued)

COMPLEX	FACILITY LIC.	FACILITY UNLIC.	ABOVE CAT 1	ABOVE CAT 2-8	BELOW CAT 1	BELOW CAT 2-8	BELOW VENT ADDED*	ABOVE & BELOW CAT 1	ABOVE & BELOW CAT 2-8	ABOVE & BELOW CAT 2-8 (W/VENT ADDED)
18	158		0	0	0	260	373	0	260	633
19	183		0	541	0	214	760	0	755	1,515
	184		0	0	0	187	165	0	187	352
	185		2,695	812	0	774	2,215	2,695	1,586	3,801
	214		83	0	0	361	0	83	361	361
	220		0	0	0	308	1,042	0	308	1,350
TOTAL			2,778	1,353	0	1,844	4,182	2,778	3,197	7,379
20	151		1,630	0	0	0	0	1,630	0	0
	152		239	0	0	0	0	239	0	0
		186	186	0	0	0	0	186	0	0
TOTAL			2,055	0	0	0	0	2,055	0	0
TOTAL LICENSED			1,869	0	0	0	0	1,869	0	0
TOTAL UNLICENSED			186	0	0	0	0	186	0	0
GRAND TOTAL			2,055	0	0	0	0	2,055	0	0
21	164		0	0	0	62	0	0	62	62
	165		0	0	0	70	0	0	70	70
TOTAL			0	0	0	132	0	0	132	132
22	178		62	0	0	113	181	62	113	294
	179		62	0	0	138	240	62	138	378
	181		0	0	59	0	0	59	0	0
	182		0	0	0	561	2,103	0	561	2,664
TOTAL			124	0	59	812	2,524	183	812	3,336
23	169		1,594	2,127	0	882	819	1,594	3,009	3,828
	170		0	0	0	400	0	0	400	400
	189		0	0	0	84	0	0	84	84
	216		0	0	0	745	1,584	0	745	2,329
	217		0	102	0	0	0	0	102	102
	218		108	202	0	0	0	108	202	202
TOTAL			1,702	2,431	0	2,111	2,403	1,702	4,542	6,945

TABLE A-1 (Continued)

COMPLEX	FACILITY LIC.	FACILITY UNLIC.	ABOVE CAT 1	ABOVE CAT 2-8	BELOW CAT 1	BELOW CAT 2-8	BELOW VENT ADDED*	ABOVE & BELOW CAT 1	ABOVE & BELOW CAT 2-8	ABOVE & BELOW CAT 2-8 (W/VENT ADDED)
24	175		385	0	0	2,756	0	385	2,756	2,756
		176	314	0	0	0	0	314	0	0
	226		1,931	0	0	0	0	1,931	0	0
	227		494	0	0	0	0	494	0	0
TOTAL			3,124	0	0	2,756	0	3,124	2,756	2,756
TOTAL LICENSED			2,810	0	0	2,756	0	2,810	2,756	2,756
TOTAL UNLICENSED			314	0	0	0	0	314	0	0
GRAND TOTAL			3,124	0	0	2,756	0	3,124	2,756	2,756
25	222		< 50							
26	213		56	0	0	225	0	56	225	225
27	221		< 50							
28	223		0	0	0	647	0	0	647	647
29)			Work still being done on these complexes--no figures yet available (12/1/65) OCD.							
30)										
SJ TOTAL LICENSED			64,532	22,049	560	31,205	54,330	65,092	53,254	107,584
SJ TOTAL UNLICENSED			8,250	2,713	266	2,014	5,410	8,516	4,727	10,137
SJ GRAND TOTAL			72,782	24,762	826	33,219	59,740	73,608	57,981	117,721

* The ventilation additions made by the NFSS, Phase II, affected basement shelter spaces, category 2-8 only.

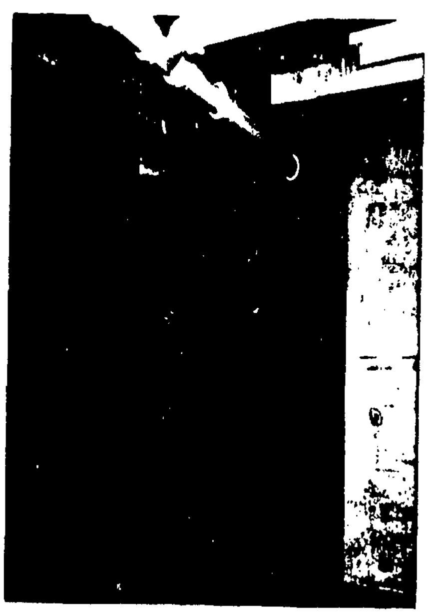
** Notation used to denote that capacity is greater than zero yet less than fifty. These figures are treated as zero in the computations.

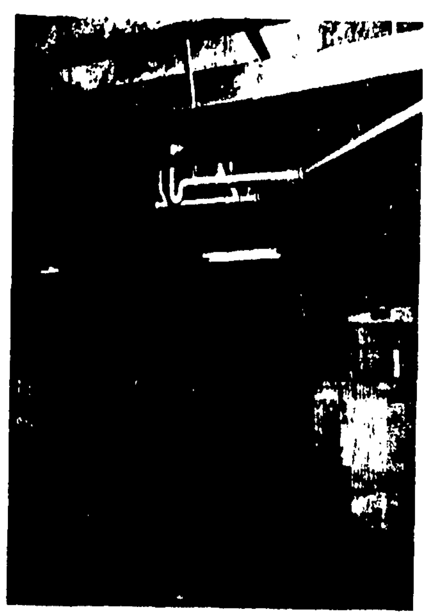
*** Notation used to denote that the NFSS, Phase II, did not investigate category 1 basements and, therefore, a figure cannot be quoted. It is possible that future ventilation additions could be assigned these shelter facilities.

Table A-2

SUMMARY TOTALS OF NFSS SHELTER CAPACITIES FOR SAN JOSE
(Individual Shelter Capacities Are at Least 50)

	LICENSED		UNLICENSED		LICENSED & UNLICENSED	
	AS IS	WITH ADDED VENTILATION	AS IS	WITH ADDED VENTILATION	AS IS	WITH ADDED VENTILATION
ABOVEGROUND						
Cat 1	64,532	no change	8,250	no change	72,782	no change
Cat 2-8	22,049	no change	2,713	no change	24,762	no change
Cat 1-8	86,581	no change	10,963	no change	97,544	no change
BELOWGROUND						
Cat 1	560	no change	266	no change	826	no change
Cat 2-8	31,205	85,535	2,014	7,424	33,219	92,959
Cat 1-8	31,765	86,095	2,280	7,690	34,045	93,785
ABOVE AND BELOWGROUND						
Cat 1	65,092	no change	8,516	no change	73,608	no change
Cat 2-8	53,254	107,854	4,727	10,137	57,981	117,721
Cat 1-8	118,346	172,676	13,243	18,653	131,589	191,329





NFSS BASEMENT SHELTER NO. 6

Table A-3

INCREASING CAPACITIES OF NFSS BASEMENT SHELTERS WITH SUPPLEMENTAL VENTILATION

Source of Information: Phase 2 Printouts and Phase 2 DCFs.

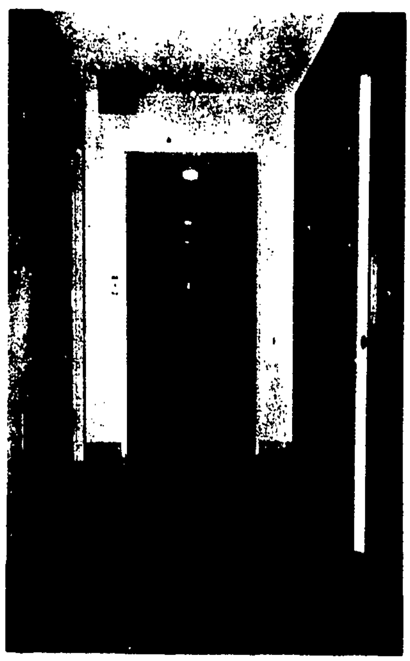
Shelters Considered: Basements in Protection Factor Category 2-8.

Total Number of Basements Considered for San Jose = 83; Total Original Capacity = 33,219.
(Including Sensitive and Non-Licensed)

Total Number of Basements Nominated for Supplemental Ventilation = 56; Capacity Added = 59,740.
(Including Sensitive and Non-Licensed)

Total Basement Capacity with Supplemental Ventilation = 92,959

Largest increase was in the Valley Fair
Shopping Center delivery truck tunnel
and basement: 8,814 spaces exist
20,568 spaces could be added with supplemental ventilation
29,382 total capacity with supplemental ventilation



NFSS BASEMENT SHELTER NO. 26

Table A-4

NFSS BASEMENT SHELTERS INSPECTED FOR POSSIBLE UPGRADING AGAINST MASS FIRE AND BLAST

FACILITY NUMBER	NFSS CAPACITIES AS IS (CAT 1-8)	FROM ADDED VENTILATION	TOTAL WITH ADDED VENTILATION
2	416	384	800
4	324	1,298	1,622
6	193	1,017	1,210
11	760	3,020	3,780
26	1,328	2,128	3,456
53	364	0	364
70	704	1,589	2,293
108	1,971	0	1,971
116	400	1,141	1,541
119	513	1,026	1,539
146	723	0	723
147	300	750	1,050
173	8,814	20,568	29,382
175	2,756	0	2,756
204	359	0	359
205	1,155	0	1,155
209	288	180	468
214	361	0	361
GRAND TOTALS (All Licensed)	21,729	33,101	54,830
SJ GRAND TOTALS (Licensed & Unlicensed; Capacities > 50)	33,219	59,740	92,959

Table A-5

SUMMARY RESULTS OF SAMPLE INSPECTIONS OF NFSS BASEMENT SHELTERS IN SAN JOSE

A. Escape in the Event of Community Fire Is Feasible . . . .

1. Shelter is located within 1/2 mile of "fire-safe open area" (outside of potential firestorm) or light residential area.

B. No Extra Hazard Exists . . . .

1. None in region. 2. None in building above. 3. None within basement.

C. Normal Basement Hazards Are Adequately Contained . . . .

1. Any boiler/heating plant, etc., is enclosed in strong, fireproof walls. 2. No shelter occupants therein. 3. No shelter supplies therein. 4. Exposed pipes are present and may need additional anchoring for a blast resistance of 5 psi.

D. Basement Structure Has a Blast-Protection Potential of 5 psi. . . . .

1. Walls: (a) Reinforced concrete or equivalent; (b) Largely buried, any protrusion above grade unlikely to reduce blast resistance appreciably. 2. Ceiling, Beams and Columns: (a) Presumably designed for at least 50 psf live load; (b) Deck of substantial reinforced concrete or equivalent. (Appreciable puncture by collapse of the structure above is unlikely.)

E. Negligible "Missile" Hazard from Glass and Other Fragments in Shelter . . . .

1. Shelterees are not exposed to glass fragments from windows smashed by blast. 2. No other source of blast-created "missiles" in basement which can affect shelterees.

F. Probability of Being Trapped in Shelter Is "Normal" . . . .

1. No special circumstances at entries to shelter likely to make Trapping worse than: "unlikely" @ 2 psi, "questionable" @ 5 psi. (Ordinary basements not generally suitable for protection at peak overpressures greater than 10 psi.)

G. No Direct Exposure of Shelterees to Flash (of Fireball) . . . .

1. Sky cannot be seen through any blast-created apertures (esp. basement windows, doorways and ramps) from region to be occupied as shelter.

H. No Direct Exposure of Shelterees to Dangerous Flame Front Outside . . . .

1. No upstairs region, neighboring building, or the ground outside (to the limit of the Factory Mutual nomograph) can be seen through any blast-created apertures from the region to be occupied as shelter.

I. No Fire in Shelter . . . .

1.a. No combustibles in shelter (so flame exposure and entering brands are unimportant as ignition sources); or

1.b. Combustibles in shelter, but their exposure to flame through blast-created apertures is not dangerous (according to Factory Mutual nomograph), and vertical openings are enclosed by strong fireproof walls so falling brands cannot reach basement contents. Shelter is provided with adequate portable fire extinguishers. . . . . .

FACILITY NUMBERS OF BASEMENT SHELTERS

	2	4	6	11	26	53	70	108	116	119	146	147	173	175	204	205	209	214
	✓	✓	✓	✓	✓	X	X	X	X	X	✓	✓	✓	✓	X	X	X	✓
	✓	✓	✓	✓	✓	✓	10	9	✓	17	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓	14	17	✓	✓	✓	✓	✓	✓	✓	26
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	6	✓	11	13	✓	17	18	✓	20	13	✓	✓	✓	✓
	✓	✓	✓	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24	✓
	✓	✓	✓	✓	6	✓	✓	13	✓	17	18	✓	21	✓	✓	✓	✓	✓
	✓	✓	✓	4	6	✓	✓	13	✓	✓	✓	X	✓	13	✓	✓	25	✓
	✓	✓	✓	✓	7	9	10	9	✓	✓	✓	19	✓	9	✓	✓	X	✓

TABLE A-5 (Continued)

J. Breathable Air During Fire Is Not Assured . . . .

1. Evacuation of shelter (to "fire-safe open area") is presently assumed necessary for breathable air in case of community-wide fire.

K. Basement Is Not Degraded Structurally by Postattack Fire . . . .

1. Reinforced Concrete walls and ceiling. 2.a. Fire in basement unlikely; or 2.b. Fire in basement likely, but burning of basement contents unlikely to collapse basement structure. (Watch post-blast fire-resistance of columns and beams supporting the ceiling.)

L. General Upgrading of Basement Shelter Is Compatible with Present Uses.

1.a. Ventilation--emergency blowers and motor-generator sets can be accommodated as required. . . . .

1.b. Note any special features which seem likely to make ventilation either especially difficult or especially easy. . . . . .

2. High-Density Occupancy--multitier shelter furnishings to increase strength, habitability and capacity are compatible with present uses. . . . .

3. Structural Strength--posts could be added to strengthen ceiling to 5 psi:

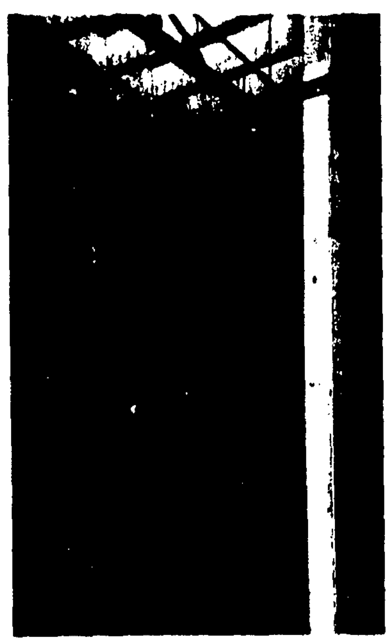
a. Permanently, or . . . .

b. Temporarily (in an emergency). . . . .

NFSS BASEMENT SHELTER NO. 119

FACILITY NUMBERS OF BASEMENT SHELTERS

	2	4	6	11	26	53	70	108	116	119	146	147	173	175	204	205	209	214
	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	-	1	2	5	-	-	12	-	15	-	-	-	1	-	23	-	5	27
	X	✓	✓	✓	8	X	X	X	16	8	8	X	22	X	X	✓	X	X
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	✓	✓	X
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



NFSS BASEMENT SHELTER NO. 173

TABLE A-5 (Continued)

EXPLANATORY NOTES

1. Large ramp opening should allow enough air to enter the shelter for all ventilation needs.

2. Existing exterior openings are only 2 doors.

3. Likely to be limited to 2 psi because roof is wooden, and elevator shaft and staircase #1 are enclosed with combustible materials.

4. Shelterees presently exposed through small openings to burning building above. Need to add fireproof partitions around elevator shaft, staircases and conveyor openings.

5. All basement openings are to building interior; makes ventilation of basement difficult when the building above is burning.

6. The central basement and the middle wing have negligible missile hazard; the 2 outer wings have too much glass--they offer inferior protection.

7. There is a fire hazard in the outer 2 wings.

8. Shelter area is the present hallways, which are heavily used. Only acceptable furnishings would have to be kept out of the way in normal times. An arrangement folding up into the hallway ceiling might be useful.

9. Central stairway may lead fire into this department store basement; basement loaded with combustible merchandise and fixtures.

10. High fire risk in this U.S. Post Office from heavy loading of basement with letters and packages.

11. Basement has many exterior windows. Occupants are screened from that glass by masonry partitions. If the partitions withstand the blast within the basement, the occupants will be protected.

12. Many exterior windows may facilitate increased ventilation.

13. Structurally sound, fireproof enclosure of (or partition around) the central stairway is needed.

14. A portion of the present space (capacity 145) contains the boiler and building machinery--not suitable for shelter.

15. No exterior openings except the main entrance to the shelter, may make additional ventilation difficult.

16. Furnishings would have to be collapsible and removable.

17. Restrict occupancy to best 3,000 sq ft of passageway; remainder presently substandard because of glass in doors and loose material.

18. OK if shelter area is restricted to corridors only.

19. Wooden stairs and basement display of furniture, etc., make fire in shelter likely.

20. Chain door on ends might be hazardous; keep chain door up out of the way.

21. People near tunnel ends may be exposed.

22. High density occupancy furnishings OK for basement storage areas; not compatible with truck access and pedestrian hallways.

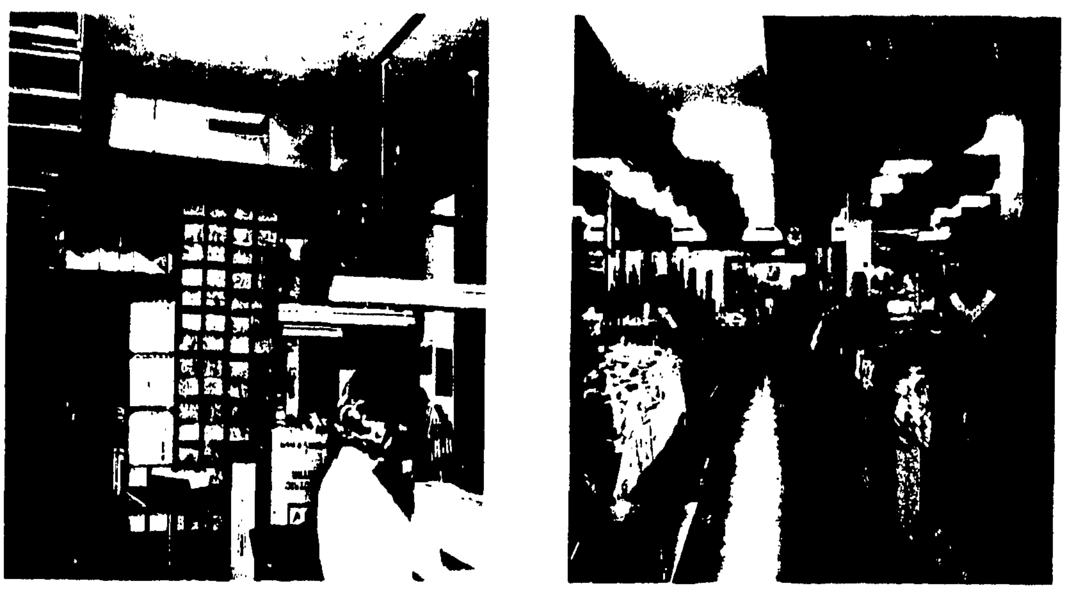
23. Only two openings, only one goes outside.

24. More than "usual" likelihood of being trapped in this basement, because only entrance is through adjacent basement with metal ceiling, beams and columns. No door on entrance, just an opening. Adjacent basement looks weak and seems likely to collect burning debris, thereby blocking exit.

25. Weak appearing metal ceiling on adjacent basement may fail, exposing shelter to exterior flame fronts.

26. Shelter supplies in boiler room should be repositioned in a non-hazardous area.

27. Future elevator planned for movable stage may facilitate ventilation.



NFSS BASEMENT SHELTER NO. 175

APPENDIX B

THE PASSIVE PROTECTION POTENTIAL OF CHANNEL DRAINAGE FACILITIES IN SAN JOSE

Because buildings are traditionally used to protect people from their local environment, it is natural to think of extending this role to include the protection possible against the hazards of nuclear war. Where buildings are inadequate or insufficient, one tends to turn to expedient excavations in the earth--trenches and foxholes--since these have served usefully in the past as protection against military dangers. However, before one digs a lot of new trenches for passive protection it seems reasonable to exploit for civil defense the ditches that already exist. The principal natural trenches are the gullies formed by streams. These will be considered in the next Appendix C. Along these watercourses there may be sections where the natural conditions have been altered by man-made improvements. These are the channel drainage facilities to be considered in this appendix.

Table B-1 on the next page lists the channel drainage facilities in San Jose, which are sufficiently large to accommodate people in an emergency. Several different types of facilities exist. One offers far better passive protection than any of the others. That is the covered culvert, the buried box or pipe big enough for a man to get into. These have been emphasized in Table B-1.

As they stand, the buried culverts of San Jose generally provide good protection from flash, blast, mass fire and radioactive fallout--Universal Protection, as required for Direct-Effects Regions; Fallout Shelter, as required for Fallout-Only Regions. They may be cold, wet, dark, and very uncomfortable; and they presently have poor access, no shelter supplies (water, food, sanitation, medical aids, and RADEF instruments), and no ready communications. But they are the only Universal Protection presently extant. Until some real blast shelters are built, identified basement shelters are upgraded, or emergency trenches are dug, the buried culverts are <u>the</u> protection for Direct-Effects Regions--for San Jose. It's too bad there are not many more!

The <u>buried</u> culverts are unique among channel drainage facilities in depending on just the surrounding earth for their physical protection. Thus buried culverts can be operated dry to advantage (for living conditions). All the other <u>open</u> drainage channels need appreciable water to be sufficiently protective against direct effects; their protection potential is based on proposed (but unproven) whole body immersion. Hence open channels must be operated wet--must have 18" or more of quiet standing water for passive protection. These two requirements for (1) dry buried culverts and (2) wet open channels may seem contradictory, until one realizes that the dams needed to keep water out of the buried culverts can also serve to insure standing water in the open channels upstream from the upstream culvert end. And in the face of possible nuclear attack, it is no longer essential to the community that storm water be promptly removed. Obvicusly the inconvenience and nuisance of diverting storm water will be less in arid and semi-arid regions. (In San Jose the total rainfall averages less than 15" per year, and normally no rain at all falls during 6 months of the year.) It thus seems feasible in a nuclear emergency to exclude much of the drainage water from the buried culverts by sand bagging their open ends (and thereby also improving the protection they provide). Other inlets to drains used as shelters should be plugged.

This may be done as part of last-minute operations to improve emergency-readiness.

Because of the significant direct-effects protection which seems to be intrinsic to buried culverts (and hard to find elsewhere), we have made them the subject of a special study. That special study has focussed on the first of the enclosed culverts listed in Table B-1, a buried reinforced-concrete box 15' wide by 13.5' high by 9,500' long, which lies under the San Tomas Aquino Expressway in San Jose. This structure has magnificent potential as shelter now for some 14,000 people--Universal Protection, protective against flash, blast, mass fire and fallout. The results of that special study take up the remainder of this appendix, following Table B-1.

Table B-1 lists existing channel drainage facilities in San Jose $\geq$ 5' in diameter for pipes, and $\geq$ 6' in depth for open channels.

Table B-1 uses the following abbreviations:

Enclosed Channel

BOX	Box Culvert
RCP	Reinforced Concrete Pipe
RCB	Reinforced Concrete Box
$X'_5 \times X'_6$	Box
X'_5	Box Span (ft)
X'_6	Box Height (ft)

Open Channel

CLC	Concrete Lined Channel
CLG	Gunite Lined Channel
CUL	Unlined Channel
$X'_1 \quad X'_2 \quad X_3{:}X_4$ CUL	
X'_1	Channel Bottom Span (ft)
X'_2	Channel Height (ft)
$X_3{:}X_4$	Slope of Channel Side

Table B-1*

CHANNEL DRAINAGE FACILITIES AVAILABLE TO SAN JOSE

Facility Number #	Size and Type	Length (ft)
1a	4' 8' 1.5:1 CUL	4,700
b	8' 7.6' 1.5:1 CUL	2,200
c	12.5' 10.5' 1.5:1 CUL	11,800
d	7.5' 9' 1.5:1 CUL	8,100
e	11' 6'-10' 1.5:1 CUL	1,200
f	9' 6'-10' 1.5:1 CUL	2,600
g	11' 6'-10' 1.5:1 CUL	3,400
h	8' 6'-8' 1.5:1 CUL	2,200
2	**15' x 13.5' RCB**	**9,500**
3	2'8' 1.5:1 CUL	2,350
4a	8' 7.6'-10' 1.5:1 CUL	4,200
b	4' 8' 1:1 CLC	500
c	**60" RCP**	**1,200**
d	8' 6.5' 1.5:1 CUL	4,200
5a	3.5' 6.5' 1.5:1 CUL	3,600
b	12' 9' 1.5:1 CUL	7,900
6a	**60" RCP**	**600**
b	**66" RCP**	**1,300**
c	**72" RCP**	**3,000**
7a	12' 6'-8' vert CLC	2,000
b	**78" RCP**	**500**
c	**72" RCP**	**1,200**
d	**66" RCP**	**700**
8a	6' 6' vert CLC	2,100
b	**60" RCP**	**1,800**
c	9' 8' vert CLC	500
d	**9' x 6' RCB**	**500**

* Master Storm Drainage Plan, County of Santa Clara, 1965.

\# Drainage facilities are located by number on the maps of Figures 19 and 20 in the body of this report.

TABLE B-1 (Continued)

Facility Number	Size and Type	Length (ft)
9a	12' 8'-10' 1.5:1 CUL	2,800
b	10' 7'-11' 1.5:1 CUL	1,900
c	8' 6'-11.5' 1.5:1 CUL	2,400*
d	60" RCP	700
10a	10' 13' 1.5:1 CLG Bottom	12,800
b	10' 11-13.5' 1.5:1 CLG Bottom	6,400
c	10' 9.6'-11.5' 1.5:1 CLG Bottom	10,500
d	8' 9.1'-17.8' 1.5:1 CUL	6,300
e	72" RCP	2,100
f	60" RCP	5,400
11	60" RCP	4,200
12	60" RCP	8,000
13a	66" RCP	4,700
b	60" RCP	11,300
14	6' 7'-13' 1.5:1 CUL	9,500*
15a	8' 7'-11' 1.5:1 CUL	2,900
b	6' 7'-12' 1.5:1 CUL	6,900
16	6' 7' vert CLC	5,500
17a	8' 20' 1:1 CUL	2,900
b	60" RCP	7,200
18a	3' 7' 1.5:1 CLG	1,400
b	78" RCP	3,300
c	66" RCP	1,400
d	2' 8' 1:1 CLG	1,600
e	60" RCP	2,200

TABLE B-1 (Continued)

Facility Number	Size and Type	Length (ft)
19	8' 8.5' vert CLC	3,500
20	6' x 5' BOX	9,700
21a	78" RCP	1,500
b	3' 9' 1.5:1 CUL	6,600
c	72" RCP	5,500
d	66" RCP	7,000
e	60" RCP	600
22a	6' 5'-9' 1.5:1 CUL	7,700*
b	72" RCP	1,800
23	4' 8'-9.3' 1.5:1 CUL	6,500*
24	60" RCP	2,500
25a	66" RCP	2,300
b	60" RCP	1,800

* Denotes total length of the facility on and off of the map area shown.

SPECIAL STUDY OF SAN TOMAS AND OTHER CULVERTS FOR PASSIVE/MULTIPURPOSE PROTECTION*

Introduction

This special study was inspired by the culvert under the San Tomas Expressway in San Jose. That expressway runs on top of what used to be the San Tomas Aquino Creek. The creek now runs under the highway for nearly 2 miles in a large culvert. That culvert has a very high Protection Factor, reasonable blast resistance and offers low cost protection, i.e. free. These favorable circumstances caused us to wonder: If this culvert could be justified for flood control, erosion control and use--such as the Expressway--would not such projects benefit from adding yet another use, that of protective shelter? Thus was formed the idea of a multi-purpose protection project. Where culverts could almost be justified for nondefense uses, adding their defense use might well make their construction worthwhile; and this might be a good way to increase passive protection in communities that are developing rapidly. Our job then was to show the economies and discuss some of the details of this approach to multi-purpose protection.

The San Tomas culvert is not a common thing, but a rather unique project. Many factors contributed to its design--wherein the open creek was put into a culvert underneath the new highway. The neighborhood where this was done was densely built up, so that an Expressway adjacent to the creek would remove many houses and structures and be very expensive. In regions less densely built up the Expressway is being built adjacent to the stream and the stream bed is being lined with concrete.

Most streams in the area are being put into lined channels as the density of dwellings increases. The protection of lined channels becomes necessary because the runoff after a storm has a high intensity and rather short duration. To control erosion and prevent flooding the stream channels must be improved. Lined channels are cheaper than culverts without considering land use, protective shelters, etc. One phase of our study then should show the incremental cost of shelter space in culverts when the cost of channel lining is subtracted and the value of the land added for useful purposes such as parks, highways, and residential areas is added.

Cost Studies

Culvert costs were based on the San Tomas culvert and the State of California Standard Highway Culvert Designs plus current Santa Clara County bid prices for such structures. Many alternatives were considered, but many more could be studied. As an example of the procedures used to estimate the incremental cost of culvert shelter, one takes the cost of putting a culvert in a stream location, subtracts the cost of a lined channel, and subtracts the value of the land added to the

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neighborhood, park or highway. Results of this kind of calculation are given in Tables B-2 and B-3. From these tables one soon sees that shelter spaces using this type of logic are quite cheap. Two different occupancies were used in computing these shelter costs--(1) volume based and (2) area based. The area basis assumes there is sufficient ventilation. An additional benefit not included in this study is the tax return which results when useful land is added to the taxable property.

Costs were estimated for various culverts on the basis of the material quantities shown on their construction drawings. In-place unit cost figures were obtained from the Santa Clara County Engineer's Office.

An "equivalent open channel (lined)" was designated for each culvert as follows: (1) same base width as culvert, (2) 1.5:1 side slopes extending to the ground surface (assumed 2' above culvert top). The channel-lining material was taken to be a spray-on concrete costing about $35/yd. The lining thickness was assumed to be 6". Where the given stream bed must be improved in any case, the cost of lining the "equivalent open channel" may be subtracted from the culvert cost to obtain the <u>added cost</u> of building the culvert shelter instead of the channel lining.

The value of the land above the culvert may be an added benefit created by burying the stream rather than leaving it in an open channel. Where it is possible to realize this value added, its dollar worth per lineal foot may be subtracted from the added cost of the culvert shelter over the lined channel per lineal foot. To allow specific examples to be calculated, values of (1) $ .10 a sq ft and (2) $ .50 a sq ft have been used. These might be appropriate if the land added or its equivalent was sold as (1) park or (2) subdivision property.

To convert these estimated costs for culverts and open channels from "per lineal foot" to a "per person sheltered" requires assumptions on the lineal feet of culvert needed per person sheltered. Two such assumptions were employed: (1) 10 sq ft per person, assuming adequate ventilation and (2) 500 cu ft per person, assuming inadequate ventilation. The results of calculations according to the first assumption are given in Table B-2; according to the second assumption in Table B-3. It is apparent from these tables that the added cost of these culverts/shelters can be very reasonable under favorable conditions.

		Unit Price In Place	San Tomas Culvert per lineal foot Quantities	$ Costs	8'x8' Single Box Culvert per lineal foot Quantities	$ Costs
CULVERT	Excavation	$ 3.00/yd	10.5 yds	31.50	3.60 yds	10.80
	Backfill	5.00/yd	1.1 yds	5.50	.35 yds	1.75
	Concrete	45.00/yd	2.12 yds	95.50	.88 yds	39.60
	Steel	.10/lb	480 lbs	48.00	179 lbs	17.90
				$180.50		$70.05
EQUIVALENT LINED OPEN CHANNEL	Excavation	3.00/yd		31.50		10.80
	Concrete	35.00/yd	1.3/yds	46.00	.82 yds	28.80
				$77.50		$39.60

Table B-2

PER PERSON COSTS OF SHELTER IN STANDARD CULVERTS WHEN EACH PERSON GETS 10 SQ FT

Culvert Dimensions	15'x13.5'	10'x10'	Single 8'x8'	Double 8'x8'	Triple 8'x8'
Cost of Culvert	$120	$104	$88	$74	$67
Culvert Minus Land @ $ .10/sq ft (as for parks)	116	99	83	71	65
Culvert Minus Land @ $ .50/sq ft (as for subdevelopment)	99	81	64	60	56
Culvert Minus Open Channel	68	54	38	39	38
Culvert Minus O.C. Minus Land @ .10	64	49	33	36	36
Culvert Minus O.C. Minus Land @ .50	47	31	14	25	27

Notes: 1) All costs are $ per shelter space.
2) Land is that saved by not using open channel.
3) The 15'x13.5' culvert is the existing one under the San Tomas Expressway. All others are California State standard.
4) Columns do not add due to rounding off.

10'x10' Single Box Culvert per lineal foot		Twin 8'x8' Box Culverts per lineal foot		Twin 10'x8' Box Culverts per lineal foot		Triple 8'x8' Box Culverts per lineal foot	
Quantities	$ Costs	Quantities	$ Costs	Quantities	$ Costs	Quantities	$ Costs
5.25 yds	15.75	7.20 yds	21.60	8.4 yds	25.20	10.0 yds	30.00
.55 yds	2.75	.70 yds	3.30	.88 yds	4.40	1.06 yds	5.30
1.32 yds	59.30	1.62 yds	73.00	2.27 yds	102.00	2.10 yds	95.00
267 lbs	26.70	207 lbs	20.70	278 lbs	27.80	295 lbs	29.50
	$104.50		$118.80		$159.40		$159.80
	15.75		21.60		26.00		30.00
.98 yds	34.50	.97 yds	34.00	1.04 yds	36.20	1.11 yds	39.00
	$50.25		$55.60		$62.20		$69.00

Table B-3

PER PERSON COSTS OF SHELTER IN STANDARD CULVERTS WHEN EACH PERSON GETS 500 CU FT

Culvert Dimensions	15'x13.5'	10'x10'	Single 8'x6'	Double 8'x8'	Trip 8'x8'
Cost of Culvert	$446	$522	$546	$464	$415
Culvert Minus Land @ $ .10/sq ft (as for parks)	431	499	516	446	401
Culvert Minus Land @ $ .50/sq ft (as for subdevelopment)	370	407	398	374	345
Culvert Minus Open Channel	255	270	238	247	235
Culvert Minus O.C. Minus Land @ .10	240	247	208	225	221
Culvert Minus O.C. Minus Land @ .50	179	155	90	157	165

Notes: 1) All costs are $ per shelter space.
2) Land is that saved by not using open channel.
3) The 15'x13.5' culvert is the existing one under the San Tomas Expressway. All others are California State standard.
4) Columns do not add due to rounding off.

Protection Factor

The San Tomas and any of the other California standard culverts always have a very high protection factor, well over a thousand in most cases--largely due to the depth of burial.

According to our rough calculations, some 97.5% of the length (9,468 feet) of the San Tomas Expressway culvert has a Protection Factor $\geq$ 1000 (against gamma-rays entering the open ends). Well within the culvert the gamma-ray dose comes chiefly from fallout on the road above. The thickness of material between culvert ceiling and roadbed above varies, at its thinnest point it is 2 ft thick--1 ft of concrete and 1 ft of earth. This leads to a minimum overhead mass thickness of 260 psf; everywhere else it is thicker and heavier (averaging 590 psf overall). In this situation, 215 psf overhead is needed for a Protection Factor of 1000. Thus the San Tomas culvert will generally have a PF > 1000, very worthwhile fallout shielding.

Heating and Ventilation

To get an idea of the amount of air moving naturally through the San Tomas culvert, a few field measurements were taken. It was found that the velocity of air passing through the culvert was very similar to that of the surface winds (which at the San Tomas culvert tend to be in the direction of the culvert). Our best estimates suggest that the normal minimum winds of this locality can ventilate 15 to 20,000 people. So capacity computations could be based on 10 sq ft per person. Other aspects of the heating and ventilation problem that were briefly considered were the installation of (1) Punkahs to supplement the natural ventilation of culverts in areas not so favorably located as the San Tomas; and (2) manually operated fans (e.g. PVK's) on the gutter inlets.

The following field measurements were made in and about the culvert under the San Tomas Expressway:

	WIND VELOCITIES in feet per minute					
Date	Outside In Front	Outside Alongside	In Culvert Entry	Inside Culvert	Well Inside Culvert	At Culvert Exit
19 Aug. 1965 (morning)	314 534	345	496 549	470	413	
24 Aug. 1965 (afternoon)	521	572 375	534			
26 Aug. 1965 (afternoon)	612	459	315	212	174	198

These were days of rather light variable winds. The data are meager but show positively that appreciable air for ventilation does pass through this culvert when the wind blows.

Strength Analysis

Rough estimates were made of the strengths of the San Tomas and a few of the California Standard culverts. These culverts are all relatively good as is--that is 5 to 8 psi overpressure would be safe. With very minor and inexpensive design changes, future culverts of this type could be greatly improved. This would make them fair blast shelters as well as good fallout shelters.

For a near worst case and many conservative approximations, the San Tomas culvert has been evaluated to have a capability of withstanding a blast overpressure of about 8 psi. This assumed the maximum thickness of earth cover--eight feet (when the average thickness is about four feet)--and the weakest construction, and no arching effect by the soil--so the culvert had to carry the entire dead load. With these assumptions, plus a 2:1 dynamic magnification factor, the top of the culvert is the weakest part. If less overburden were used, the overpressure capability would improve slightly and the sides would become critical.

New Features Needed

Some lighting is highly desirable. It is surprising that during the daytime the few overhead inlet drains along the length of the San Tomas culvert provide enough light so that one can almost walk along as it is. Thus, very little additional light will be needed for daytime use, but more would be in order for nighttime. Storehouses could be built, either along the culvert on the surface or underground to store supplies, food and bedding, etc. On the San Tomas, accessibility should be improved--for example, the manholes could be unwelded so that people could get into them, and a few additional ladders could be stored to put down the overhead drains where there are no ladders.

Other features to be considered for the culvert as a protective shelter include: First is the use of hammocks for people to sleep. The culvert seems almost made to order for hammocks. Hooks could be set into the concrete at the time of construction or in culverts already built. The second suggestion is to make available removable sections in the floor of the culvert for people to dig wells. In the dry seasons of the year, the water table is reasonably close; this would give people an additional supply of drinking water and exercise. The third idea is to lower part of the culvert floor to keep small flows of water away from the occupants, to improve their living conditions.

Storm Frequency

When we propose putting thousands of shelterees into culverts intended to remove excess rainwater, the question naturally arises as to the likelihood of storms filling the drainage facilities with too much water for them to be occupied. To answer this question, an estimate was made of the probability of occurrence of a flood during a two-week period. The criterion used was that water over three feet deep was likely to wash any occupants out of the culvert. It turned out that for the San Tomas—and this also would be true for most of the streams in the Santa Clara Valley—there is less than 1/2% chance of the depth of water exceeding three feet in any two-week period. This in itself does not look too bad. Additionally, protective sand bagging of the upstream open end of the culverts prior to occupancy can effectively eliminate this hazard.

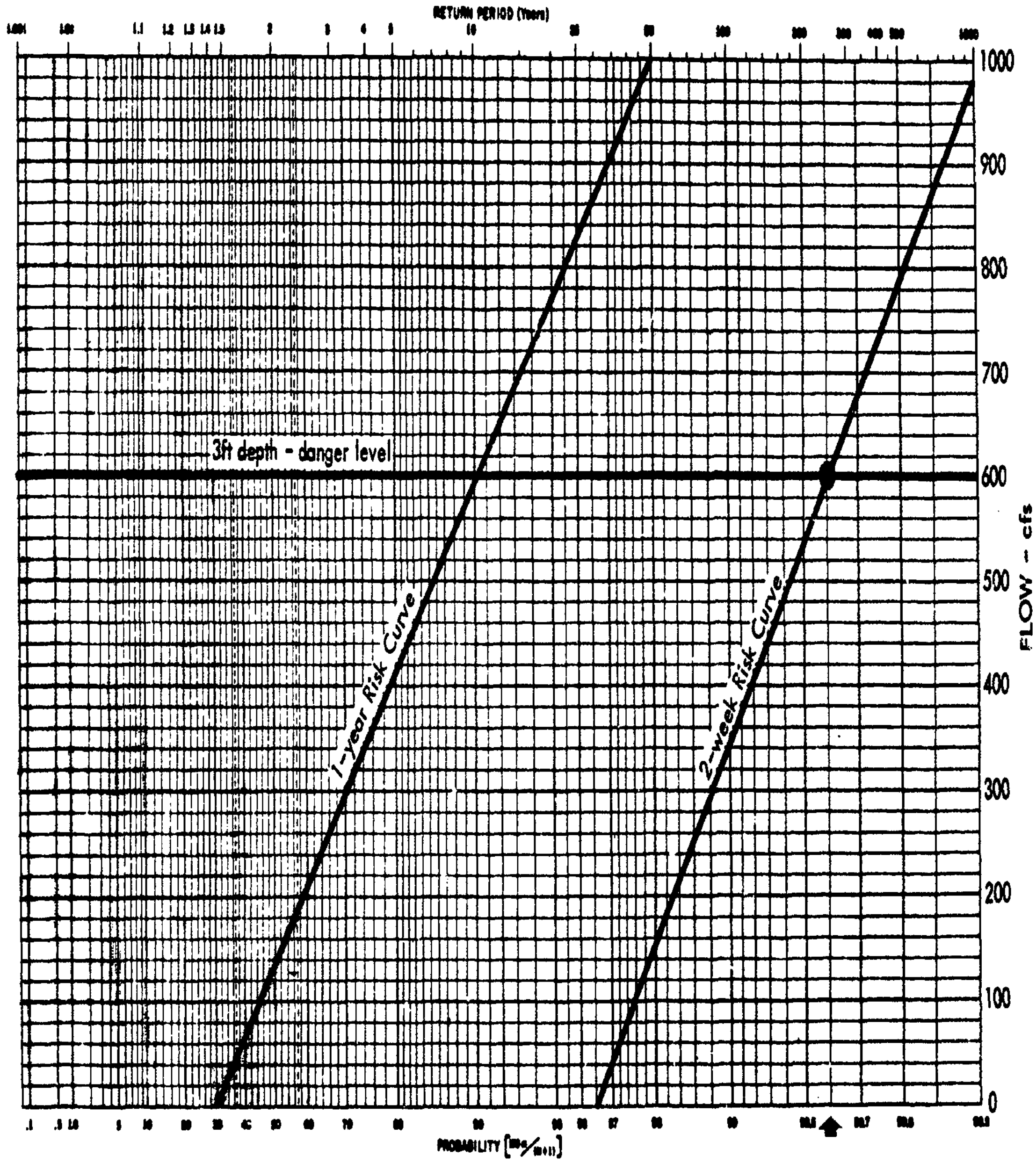
Three feet of water flowing in the San Tomas culvert seem likely to render it untenable for shelter. Calculations showed that a 3 foot depth required a flow of about 600 cubic feet/sec (cfs) in that channel. Historical records of water flows in the San Tomas Creek were checked and are reproduced on the opposite page. The graph there shows that the probability of exceeding 600 cfs during a 2-week period is about 0.4%. Based on historical flows then, during any 2-week occupancy of the San Tomas culvert (for shelter purposes) there would be only about 1 chance in 250 that 3 or more feet of water would be there at the same time.

Summary

In summary it appears that much could be done for multi-purpose protection by the proper use of culverts in the Santa Clara Valley. When one looks at the number of stream channels that are being lined, the rate of growth of the area, the need for new usable land and highways, it seems that much of the population could be protected in culvert-like shelters for perhaps less than $20 per person on the average. This is not to say that the total project is $20 per capita; this is to say that the additional costs over and above lined channels is only about $20 per person based on the logic and multi-purpose costing used here. The other pleasing factor, of course, is the high protection of such a low-cost shelter. With a little planning, one could withstand 20 psi overpressure and have a fallout protection factor in excess of a thousand for most of the length of the shelter.

Figure 8-1

PEAK STREAMFLOW FREQUENCY, SAN TOMAS CREEK -- JANUARY 1963



SOURCE: "Hydrologic Atlas, Santa Clara County," Santa Clara County Flood Control and Water Conservation District, 1963.

APPENDIX C

BASIC FORMS OF EARTH AND WATER SHIELDING FOR EMERGENT PROTECTION FROM NUCLEAR WEAPONS EFFECTS

At the present time, the bulk of the available shelter in most American communities--including San Jose, California--is vulnerable to mass fire (as is likely to develop postattack in Direct-Effects Regions). People taking shelter in such facilities prior to attack may thus be driven out and left totally exposed outdoors. For such people, deprived of their expected protection by the direct effects of nuclear explosions or the consequent fire, there is good reason to consider any kind of shelter or shielding--however humble--which they can use. In their efforts to escape the terrible effects of the mass fire, the survivors who are able to move will generally seek refuge where fire effects are least, i.e. in: (1) large incombustible open areas, and (2) available standing water. The shielding which is most likely to be found or most readily created in such places consists of crude arrangements of massive amounts of earth and water. The purpose of this appendix is to examine the characteristics of the basic forms of earth and water shielding of possible value for emergent shielding from the direct effects and from the radioactive fallout from nuclear explosions.

On the chart on the next page there are displayed the different geometries of earth and water of possible interest for emergent shielding from flash, blast, mass fire and fallout. The extent of the shielding provided by earth is greatest at the top and decreases from top to bottom. The extent of the shielding provided by water is least in the left-hand column, and increases from left to right.

Rough evaluations are indicated by the descriptive terms under each cross-section. Starting with the top row featuring a massive cover, as is well known this arrangement can provide very useful protection against all nuclear weapons effects (Universal Protection). The critical feature is generally the cover, especially its strength (against blast) and its mass per unit area (against fallout gamma radiation on top).

In the body of this report it is recommended that trenches be excavated in the interior portions of large incombustible open areas (public school grounds and parks) to provide shielding against direct effects and radioactive fallout for persons without suitable shelter when nuclear attack threatens. And those trenches should be covered. Simple covers for trenches 2 ft wide were imagined to consist of 12" of earth on wooden planks, 6 feet long, uniformly supported by the soil over the last 18" of their lengths. It is useful to know how thick a covering plank is required to provide a given blast resistance. These relations are given in Table C-1.

Adding water of shallow depth does not affect the protection of the covered trench (but it will degrade the living conditions). Adding sufficient water for immersion (third panel, first row) should improve the gamma ray shielding somewhat--but this is not generally necessary or desirable. Really deep water in this enclosed situation (the fourth panel) would be pointless and nothing but a nuisance.

BASIC FORMS OF EARTH AND WATER SHIELDING TO CONSIDER FOR DIRECT-EFFECTS REGIONS

The second, third and fourth rows from the top all have the same deep narrow trench; they differ in the cover, which can be anything but massive. Hence we see (1) a decontaminated lightweight cover (recommended by reports* of the Research Triangle Institute for fallout protection), (2) a contaminated lightweight cover, and (3) no cover at all. In general, all of these are useful configurations if the trench is sufficiently narrow and deep. It wants to be deep enough to keep the occupants below grade and out of the "line of fire" of the direct unscattered gamma rays from fallout on the ground. And it should be narrow enough to limit to acceptable values the solid angle of skyshine in all cases, and the amount of fallout on the cover or in the trench in the second and third cases. Trenches having depths approximately equal to the height of their occupants would offer similar protection in the second (contaminated lightweight cover) and third (no cover) cases. Keeping lightweight covers in place in the face of the flash and blast from a nearby nuclear explosion may, of course, be easier said than done. However, if such covers do not endanger the occupants of the trench by their ignition, their destruction, or their removal, then they can scarcely add to the hazards. These thoughts suggest that the open trench (with no cover) is the basic form to analyze. It should endure, while lightweight covers may or may not survive or be erected postattack.

We show in Table C-2 the approximate Protection Factors for man-sized open trenches of various widths. It is apparent that (1) protective trenches which are open and contaminated should be kept narrow: preferably no wider than about 2 ft. Table C-2 also reveals (2) the minor benefits of a foot of water in the trench as well as (3) a trench that has been decontaminated. These results demonstrate the positive protective value of these crude forms of shielding--where nothing better is available.

Of course, in Direct-Effects Regions, there are other things to worry about than just fallout. There is the flash from the fireball and there is blast. To defeat the former it is assumed that people crouch down in the shadow of the trench, or provide their trench with a lightweight opaque cover. And following U.S. military practice, the blast protection of narrow trenches is taken to fail at about 10 psi peak overpressure.

All subsequent rows deal with depressions in the earth which are wider than narrow trenches. Once we leave the protection of the two earth walls of the narrow trench, we must provide something else to guard against blast and flash. That something else may be water. A body immersed in water should be appreciably protected from all nuclear weapons effects. So the configurations from row 5 through row 8 are judged to be useful for direct-effects protection only when they contain enough water for whole-body immersion.

We have no basis for estimating the "psi protection" provided by water immersion (with or without protection for the head, if exposed). We have assumed water immersion provides protection up to 2 psi peak overpressure; but we cannot justify the selection of that value. Estimates of the Protection Factor of these various configurations of earth and water will be found in the next section.

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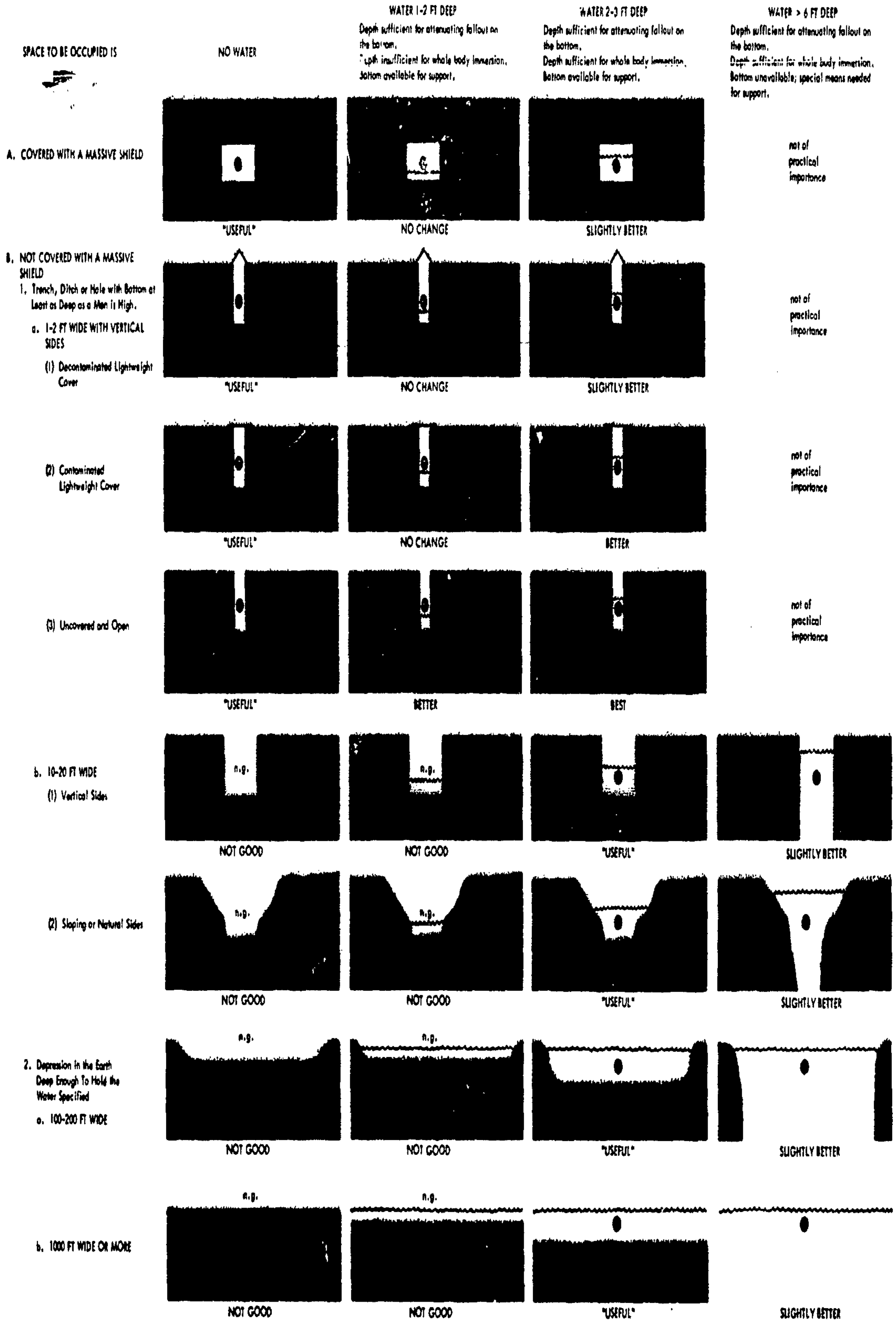
* K.E. Willis, P.B. McGill and R.H. Thornton, Crash Civil Defense Program Planning, Final Report: Volume I, Research Triangle Institute for the Office of Civil Defense, 31 December 1964.


SPACE TO BE OCCUPIED IS
NO WATER
WATER 1-2 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth insufficient for whole body immersion.
Bottom available for support.
WATER 2-3 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth sufficient for whole body immersion.
Bottom available for support.
WATER > 6 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth sufficient for whole body immersion.
Bottom unavailable; special means needed for support.
A. COVERED WITH A MASSIVE SHIELD
"USEFUL"
NO CHANGE
SLIGHTLY BETTER
not of practical importance
B. NOT COVERED WITH A MASSIVE SHIELD
1. Trench, Ditch or Hole with Bottom at Least as Deep as a Man is High.
a. 1-2 FT WIDE WITH VERTICAL SIDES
(1) Decontaminated Lightweight Cover
"USEFUL"
NO CHANGE
SLIGHTLY BETTER
not of practical importance
(2) Contaminated Lightweight Cover
"USEFUL"
NO CHANGE
BETTER
not of practical importance
(3) Uncovered and Open
"USEFUL"
BETTER
BEST
not of practical importance
b. 10-20 FT WIDE
(1) Vertical Sides
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
SLIGHTLY BETTER
(2) Sloping or Natural Sides
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
SLIGHTLY BETTER
2. Depression in the Earth Deep Enough To Hold the Water Specified
a. 100-200 FT WIDE
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
SLIGHTLY BETTER
b. 1000 FT WIDE OR MORE
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
SLIGHTLY BETTER

BASIC FORMS OF EARTH AND WATER SHIELDING TO CONSIDER FOR FALLOUT-ONLY REGIONS

On the facing chart are the different configurations of earth and water to consider for emergent shielding from radioactive fallout only. The shielding provided by the earth is greatest at the top of the chart, and it is of reduced importance as one goes down the page. The shielding provided by the water component is least on the left side, and it gains in significance as one moves to the right.

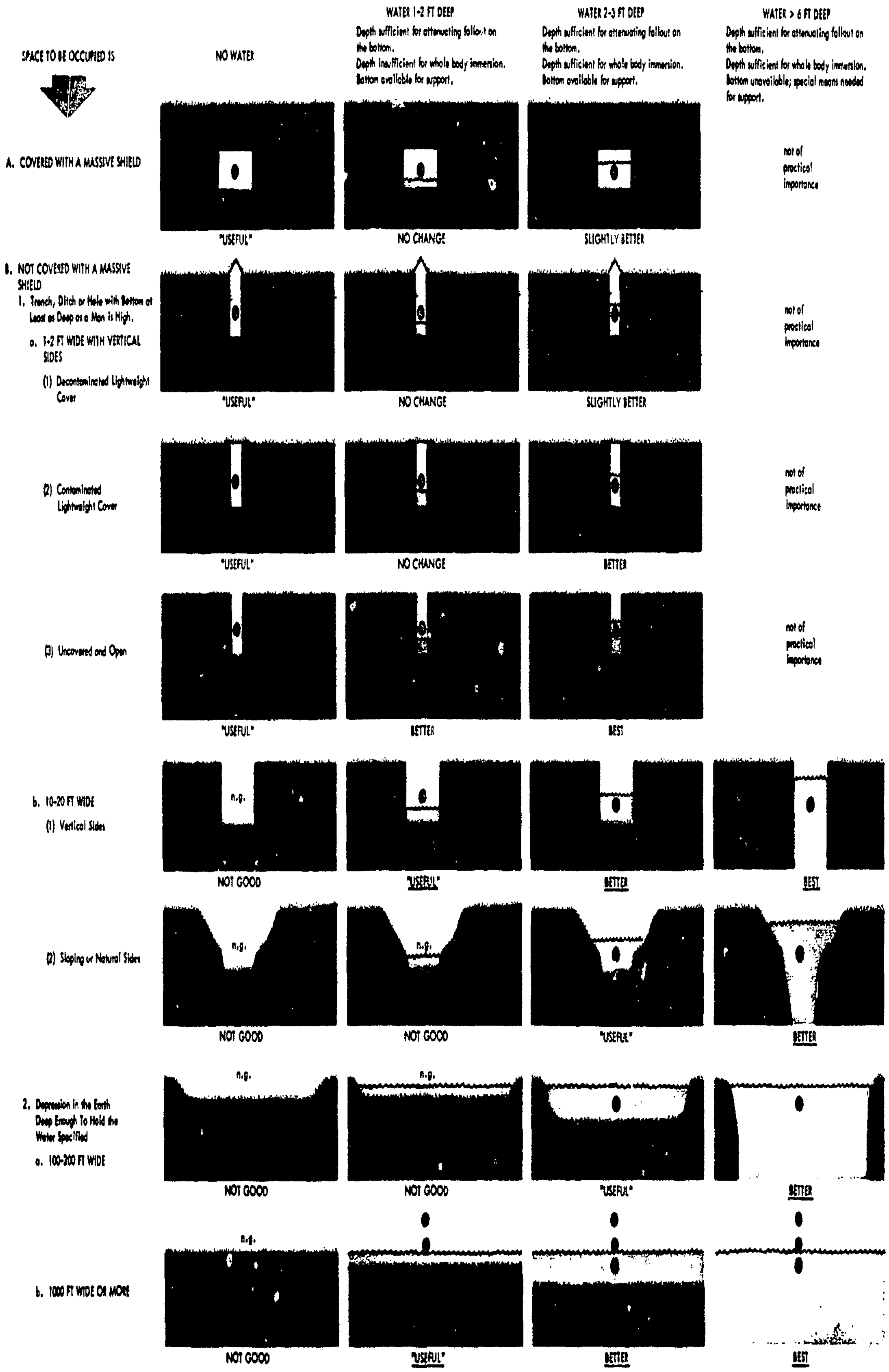
Protection Factors for the configurations in the 2nd, 3rd and 4th rows are given in Table C-2 as a function of trench width (for trenches 6 ft deep). Again: Dry trenches containing fallout must be narrow ($\leq$2 ft) to give a "useful" Protection Factor.

The 5th and 6th rows deal with channels or gullies that are appreciably wider than the trenches of rows 2-4. They are still deep enough to keep their occupants below grade. Row 5 differs from row 6 in the nature of the confining walls or banks. The 5th row has vertical improved walls; the 6th has sloping improved walls or natural unimproved banks. Because of the considerable width of these channels, it is presumed to be impractical to cover over their open tops with expedient means, or to decontaminate effectively their bottoms (and sloping sides). Since these configurations are no longer narrow, we know (from Table C-2) that their dry forms (column 1) will not have a worthwhile Protection Factor. With shallow water in the bottom (column 2) there may be enough shielding to be useful, but only if the walls are vertical (only row 5).

A special case of this character which may have practical importance is the swimming pool, especially the private home swimming pool. Table C-3 looks in particular at the kind of protection obtainable in a very ordinary swimming pool of this type, when partially filled with water. The persons in the pool are shielded from fallout on the bottom by 2 or more feet of water. Their gamma-ray dose comes largely from skyshine, as limited by the solid angle defined by their position in the pool. Please note that whole body immersion is not involved in this instance. The people involved could be entirely out of the water (but below ground level) sitting or lying on a platform or float, or standing on the bottom in rubber hip boots. The configuration is that of the 5th row, 2nd column. According to Table C-3, the Protection Factor in such a pool is never less than about 20 anywhere, and it is up around 50 in the corners. These may be worthwhile values if no better protection is around, and for homes without basements the nearest swimming pool may well be the most protective asset on hand.

Table C-4 shows the results of some calculations of Protection Factors for the 5th and 6th rows. Water depths of 1 ft or 2 ft are present, channel depths are constant at 6 ft, and various slopes and widths are used. In spite of the water, the Protection Factors are disappointingly low, and low irrespective of channel width or water depth (up to 2 ft). The principal sources of difficulty are the sloping sides above the water and their capability for collecting fallout which can irradiate directly the people within the channel. To gain appreciable protection from fallout in these cases, it is necessary to immerse the body in water, as suggested by columns 3 and 4 (of rows 5 and 6). With the body immersed and surrounded by appreciable thicknesses of water, shielding is provided against the gamma radiation coming (1) directly from the sloping walls above the water level, (2) directly from the sloping walls and bottom under water, and (3) indirectly, as skyshine, from the fallout on the ground about the channel.

In row 7 we go to still wider bodies of water. This normally allows one to neglect the fallout on the banks exposed above the water, unless those banks are unusually high. Now the principal remaining gamma irradiation consists of skyshine; so once again whole-body immersion offers the best protection from fallout.


SPACE TO BE OCCUPIED IS
NO WATER
WATER 1-2 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth insufficient for whole body immersion.
Bottom available for support.
WATER 2-3 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth sufficient for whole body immersion.
Bottom available for support.
WATER > 6 FT DEEP
Depth sufficient for attenuating fallout on the bottom.
Depth sufficient for whole body immersion.
Bottom unavailable; special means needed for support.
A. COVERED WITH A MASSIVE SHIELD
"USEFUL"
NO CHANGE
SLIGHTLY BETTER
not of practical importance
B. NOT COVERED WITH A MASSIVE SHIELD
1. Trench, Ditch or Hole with Bottom at Least as Deep as a Man Is High.
a. 1-2 FT WIDE WITH VERTICAL SIDES
(1) Decontaminated Lightweight Cover
"USEFUL"
NO CHANGE
SLIGHTLY BETTER
not of practical importance
(2) Contaminated Lightweight Cover
"USEFUL"
NO CHANGE
BETTER
not of practical importance
(3) Uncovered and Open
"USEFUL"
BETTER
BEST
not of practical importance
b. 10-20 FT WIDE
(1) Vertical Sides
n.g.
NOT GOOD
"USEFUL"
BETTER
BEST
(2) Sloping or Natural Sides
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
BETTER
2. Depression in the Earth Deep Enough To Hold the Water Specified
a. 100-200 FT WIDE
n.g.
n.g.
NOT GOOD
NOT GOOD
"USEFUL"
BETTER
b. 1000 FT WIDE OR MORE
n.g.
NOT GOOD
"USEFUL"
BETTER
BEST

Lastly in row 8 we consider the situation with really large bodies of water--farther than 1000 feet from shore--where the distance from land is sufficient to eliminate skyshine. Now we need be concerned only with fallout in the water in the vicinity of the subject and the only shielding needed is enough water between fallout and subject. Since all the gamma radiation of significance originates within the water, the subject will find roughly equivalent fallout protection in, on or above the water surface. In all cases the subject and any supporting pier, raft, boat or bridge may have to be decontaminated or otherwise kept free of damaging amounts of radioactive fallout. Substantial protection from fallout is seen to be provided by large expanses of open water.

* * * * *

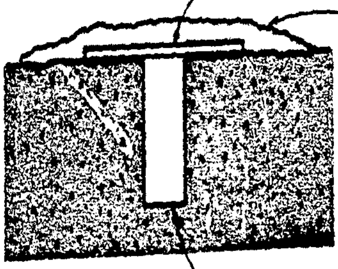
When we speak of protective shielding by simple trenches in the earth, or the water in swimming pools, or some other humble configuration of massive matter, we are well aware that these arrangements leave much to be desired. However they do offer appreciable protection from nuclear weapons effects and where nothing better is available that protection may be invaluable. In using such crude procedures one may have to bring more with him than would be the case with more elegant, more complete, more self-sufficient shelter. We attempt to illustrate this point by Table C-6. This shows that cruder protection tends to demand more supporting adjuncts. So if the shelter or shielding doesn't provide it, the shelteree may have to bring it with him.

In concluding we note that the practicality of fallout protection by long term immersion of most of the body in water has yet to be proven. For long term water immersion tends to produce serious problems of its own involving: low body temperatures, loss of body fluids, circulatory difficulties and damage to the skin. While we know that protection from the fallout gamma radiation can in principle be provided by water as well as by any other equivalent mass, we do not yet know how to insure that the body does not suffer unduly from the prolonged contact with the "protective" water. This is believed to be an area worthy of research and development: To bring to practical realization the important potential of water shielding for civil defense.

Table C-1

APPROXIMATE BLAST RESISTANCE OF 6-FOOT WOODEN PLANKS SUPPORTING 12 INCHES OF EARTH OVER A TRENCH 2 FEET WIDE

Lumber: #1 Dimension or Structural and only small (≤ 3/8") tight knots in center third.

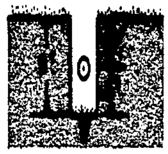
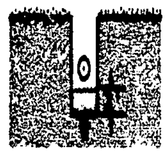
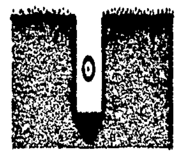


Plank Thickness		Approximate Blast Resistance
Nominal	Actual	
2"	1-5/8"	4.9 psi
3"	2-5/8"	10.5 psi
4"	3-5/8"	14.6 psi
5"	4-1/2"	18.3 psi

SOURCE: H.L. Murphy of SRI

Table C-2

APPROXIMATE PROTECTION FACTORS OF OPEN TRENCHES, 6 FEET DEEP, WITH VERTICAL SIDEWALLS

	(1)	(2)	(3)
TRENCH CONFIGURATION			
TRENCH WIDTH "W"	Fallout in trench	Fallout in trench; 1 ft H_2O in trench	No fallout in trench; skyshine only
2'	20	35	110
3'	13	25	75
4'	10	20	60
5'	8	16	45
6'	7	14	40

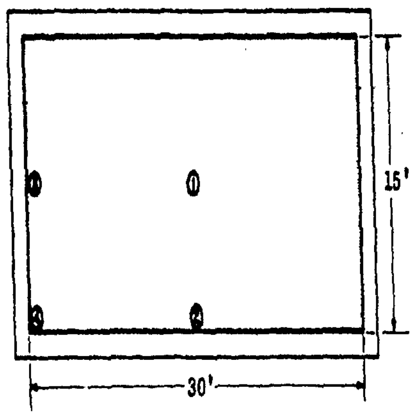
SOURCE: H.L. Murphy of SRI

Table C-3

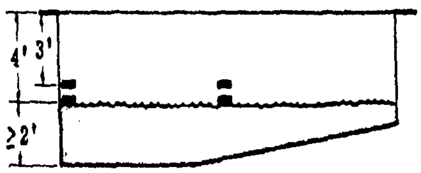
APPROXIMATE PROTECTION FACTORS OF PARTIALLY FILLED SWIMMING POOLS

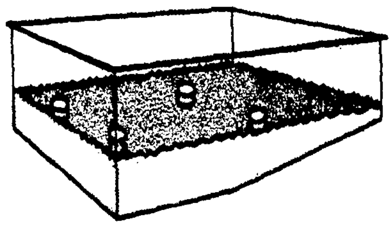
Swimming pool is taken to be 15' x 30', whole body is below ground level, detector is 3' or 4' below ground level, water depth $\geq$ 2'.

PLAN



ELEVATION





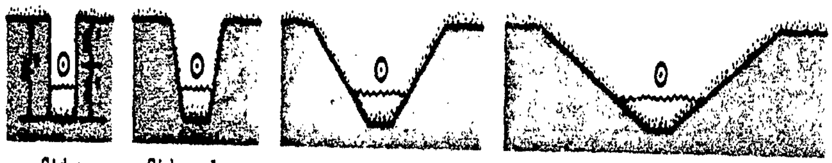
DETECTOR DIP BELOW GROUND LEVEL	DETECTOR PLAN POSITION (1) Center of Pool	(2) Middle of Long Wall	(3) Middle of Short Wall	(4) Any Corner
3'	17	27	34	51
4'	21	32	39	57

SOURCE: H.L. Murphy of SRI

Table C-4

APPROXIMATE PROTECTION FACTORS OF OPEN CHANNELS, 6 FEET DEEP, WITH SLOPING SIDEWALLS (Fallout in Trench and on Sloping Sides)

CHANNEL CONFIGURATION



CHANNEL WIDTH "W"	WATER DEPTH "D"	Sides vertical	Sides slope 1/4:1	Sides slope 1:1	Sides slope 2:1
2'	1'	35	8	4	-
	2'	-	10	5	4
10'	1'	11	8	5	-
	2'	-	13	7	4
20'	1'	-	8	-	-
	2'	-	12	-	5

SOURCE: H.L. Murphy of SRI

Table C-5

APPROXIMATE PROTECTION FACTORS FOR LARGE OPEN EXPANSES OF WATER

Depth of water in feet	APPROXIMATE PROTECTION FACTOR: If all fallout sinks to bottom	If 10% of fallout dissolves and remainder goes to bottom
0.5	7	-
1.0	20	-
1.5	43	22
2.0	91	36
3.0	400	74

Table C-6

PROTECTION NEEDED FOR AND PROVIDED BY DIFFERENT SHELTERS AND SHIELDING AGAINST RADIOACTIVE FALLOUT

PROTECTION NEEDED	RADIOACTIVE FALLOUT	WATER EXPOSURE	WEATHER EXPOSURE	TEMPERATURE EXTREMES
INDOOR SHELTER	**Shelter provides all protection needed with the help of normal clothing**			
SEMI-OUTDOOR SHELTER	**Shelter provides protection against everything but temperature**			Extra clothes may be needed
OUTDOOR EARTH SHIELD (protected against flooding)	**Shielded against fallout and water exposure**		Foul weather gear may be needed	
OUTDOOR EARTH AND WATER SHIELD	**Shielded against fallout**	Water protection <u>may be</u> needed		
OUTDOOR WATER SHIELD	**Shielded against fallout**	Water protection <u>will be</u> needed		

APPENDIX D

PRINCIPAL CREEKS AND RIVERS IN SAN JOSE AND THEIR DEVELOPMENT FOR WATER SHIELDING

The previous Appendix C introduced the idea of water shielding for protection against the effects of nuclear weapons. If this procedure proves valuable for passive protection, it may be important to know where water shielding might possibly be obtained in San Jose. One conspicuous possibility would seem to be the creeks and rivers which flow through the City.

Current Conditions of Streams

Figure 21 in the body of this report shows the locations of the principal streams and stream beds which pass through San Jose. Included in that Figure are alpha-numerical designators along each water course. Those are the keys to the illustrative photographs which appear in this appendix. Each combination of letter and number on the map specifies a point where a photograph was taken to record stream characteristics. (Stream conditions were springtime, several days after a small rain storm.) Photographs were normally taken looking downstream (unless there happened to be something noteworthy upstream). Selecting a given letter determines the stream involved; taking the numbers in order gives consecutive views of the stream from upstream to downstream. Most photographs include a person with arms outstretched (6 ft high x 6 ft wide) for scale.

Plans for Future Stream Development

While the streams of San Jose in their present condition may be of some small value for passive protection, their usefulness in that role can probably be increased considerably by (1) raising the level of the standing water (so total immersion is possible throughout the year), (2) clearing out unnecessary combustible contents, and (3) improving access. All of these measures seem compatible with programs for stream improvement which might be promulgated for park and recreational purposes. And seemingly, if the same stream improvements are useful for both passive protection and recreation, there is a better chance that they will be done.

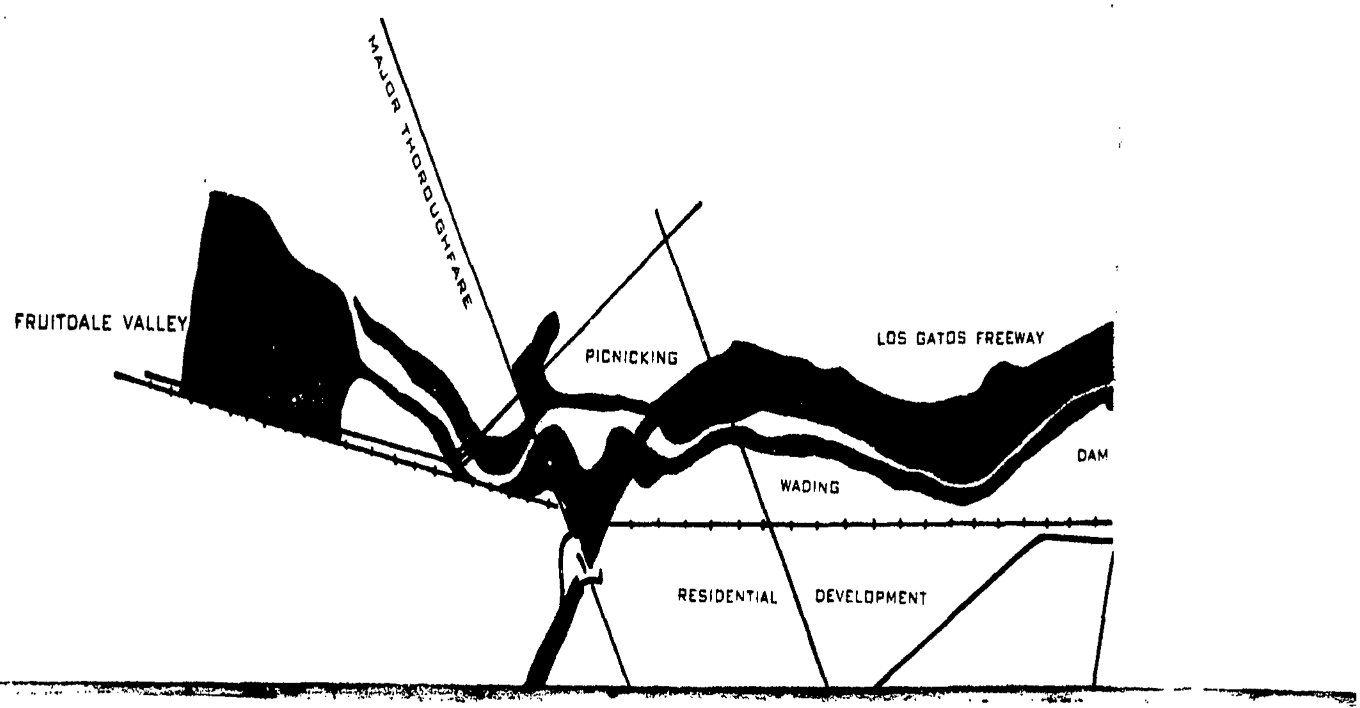
Thus because water shielding could conceivably turn out to be a useful form of nuclear protection in the absence of something better, and since water shielding in San Jose should benefit by stream improvement, we would do well to note other forces at work who are also interested in stream improvement. In particular, there has been an effort for some time to develop the streams of San Jose and Santa Clara County for park and recreational purposes. This program for future stream development is reviewed briefly on the next page. Following that is the record photography of the creeks and rivers of San Jose as they are.

RELATED (BUT NON-CIVIL DEFENSE) PLANS FOR STREAM IMPROVEMENTS--FOR PARKS AND RECREATION

As stated in "A Plan for Parks, Recreation, and Open Space" (February 1962) of Santa Clara County:

"The streams which flow from mountains to bay through the Santa Clara Valley are rich in beauty and recreation opportunity....selected stretches of streamside have been identified which should be preserved for public enjoyment. In some places public access by trail can be provided along with flood control maintenance easements. In other places Water Conservation District ownership provides a k.y to public use. The many percolation dams now in use or planned for the future provide small ponds inviting for wading and splashing, model boat sailing, fishing. Some of these areas can be advantageously incorporated into the park system, with the addition of picnic and sanitary facilities. Along with recreation roads, streamside preserves accessible by trail can serve as connecting links in the park system.

"The scheme below shows how a streamside preserve could be integrated with a freeway and with small parks to create an environment pleasant to pass through or tarry in. Opportunities for such development are especially good along the Coyote, Los Gatos and Stevens Creeks."



Palo Alto Times

Weather Forecast

Cloudy today and tonight with showers. Mostly fair Sunday ... low this morning. More weather data on page 3

IN FOUR SECTIONS PALO ALTO, CALIFORNIA, SATURDAY, DECEMBER 11, 1965 10c Copy—$2.00 Month

State Park Commission OK's Coyote Parkway

Major park projects in San Mateo and Santa Clara counties won approval from the State Park Commission Friday, but on a trimmed down basis.

The commission approved $2.5 million for the proposed Coyote River Parkway in southern Santa Clara County. Another $1 million was earmarked for the planned Ano Nuevo State Reserve at the souther coastal tip of San Mateo County.

The approvals were part of a ...ommended package of park ...ds totaling $40.8 million.

...mmission Chairman Alfred ...tera of Palo Alto said the ...ission was faced with ex... pressure for funds for ...use. About 35 projects throughout the state were rejected entirely.

The Coyote River project was sliced from $4.5 million earmarked by the same group last April.

As originally planned, the Coyote chain would stretch from Kelley Park in San Jose up 17-mile to Anderson Reservoir. The city of San Jose and Santa Clara County have offered to match state funds.

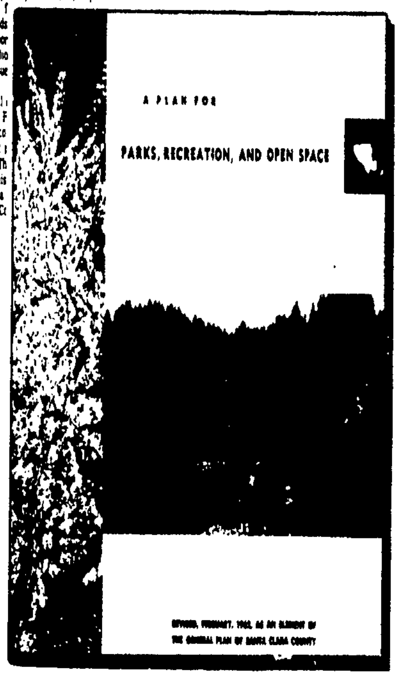
The Ano Nuevo reserve approval was for a 300-acre acquisition, down from earlier proposals.

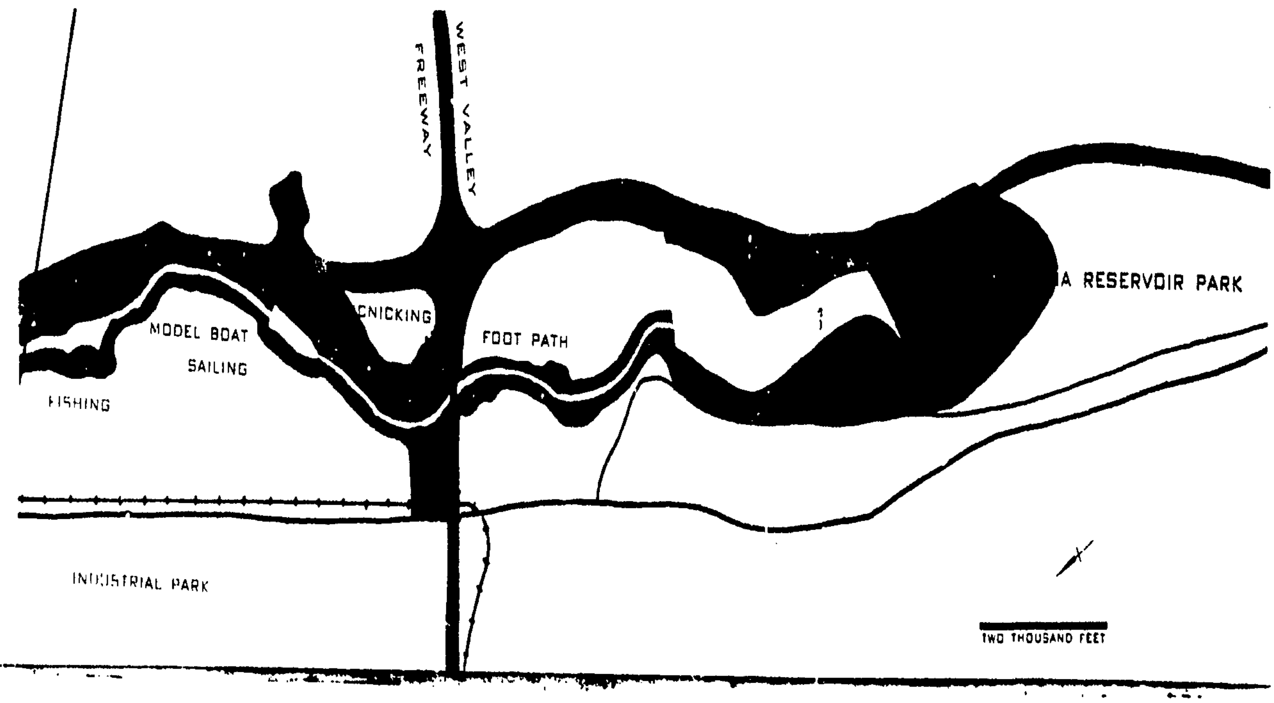
The commission approved a $4 million, 4,312 acre addition to Mt. Tamalpais State Park in Marin County north of San Francisco. But a state park for Bodega Head in Sonoma County was taken off the commission's list of recommendations after members learned that the price of the property was set at $1 million.

Thursday the commission included Bodega Head in its list at a proposed price of $225,000.

Money f... park lands ... $44 million ... $150 millio... bond issue ... in 1964.

Several ... mended F... by the co... year but ... lature. Th... Tamalpais ... the Bolsa ... Orange C...

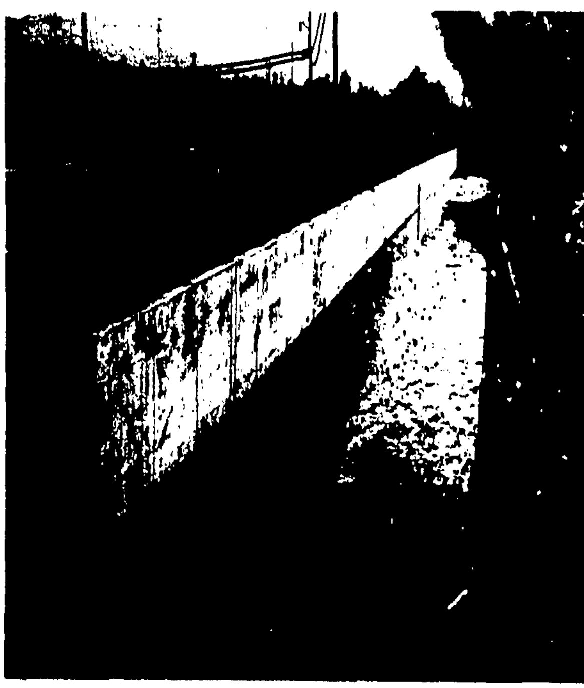




A. SAN TOMAS AQUINO CREEK

1A

2A



6A

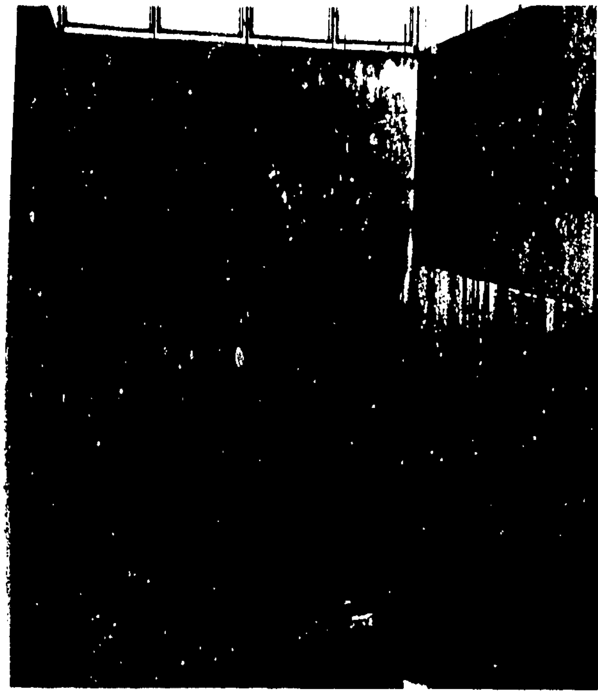
7A

3A 4A 5A

8A 9A

A. SAN TOMAS AQUINO CREEK (Continued)

10A



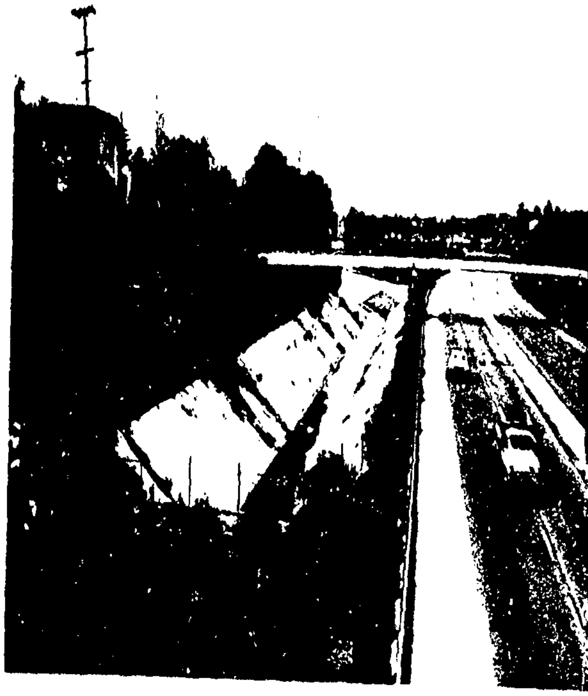
11A

12A

13A

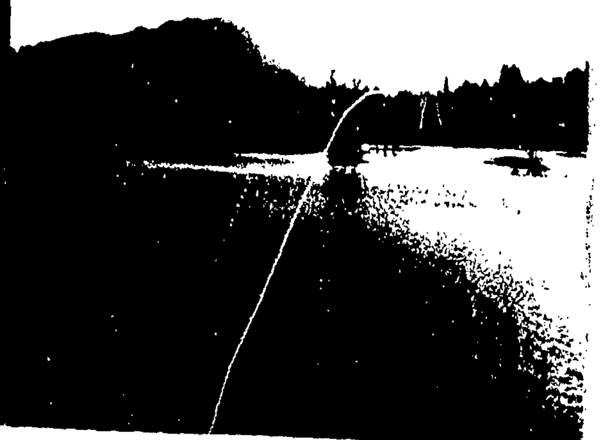
B. LOS GATOS CREEK

1B



2B

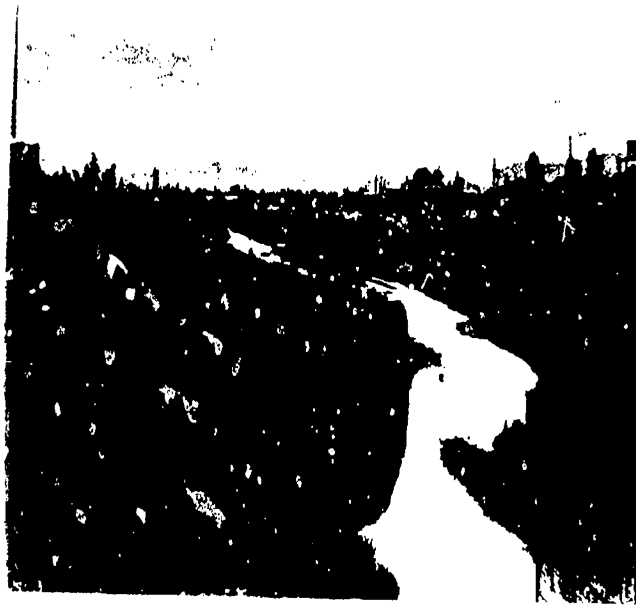
3B



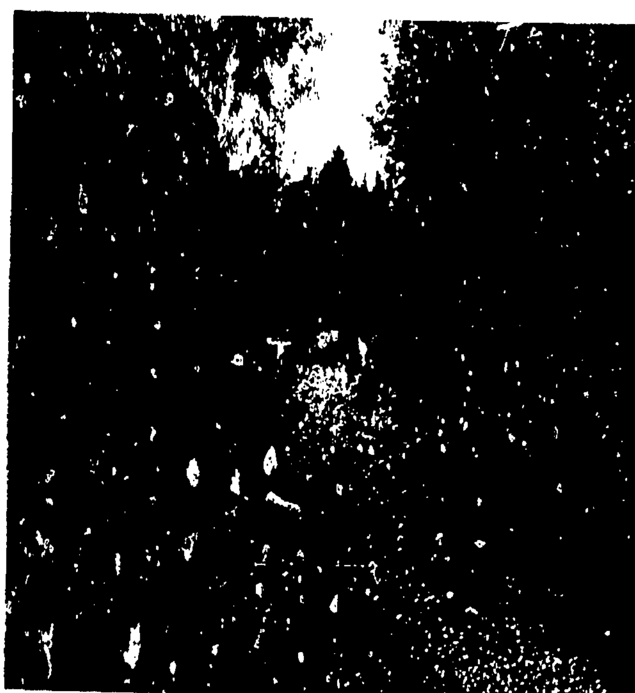
4B

B. LOS GATOS CREEK (Continued)

5B



6B



9B

10B

7B

8B

11B

12B

C. GUADALUPE RIVER

1C

2C

5C

6C

3C

4C

7C

8C

C. GUADALUPE RIVER (Continued)

9C

10C

14C

15C

11C

12C

13C

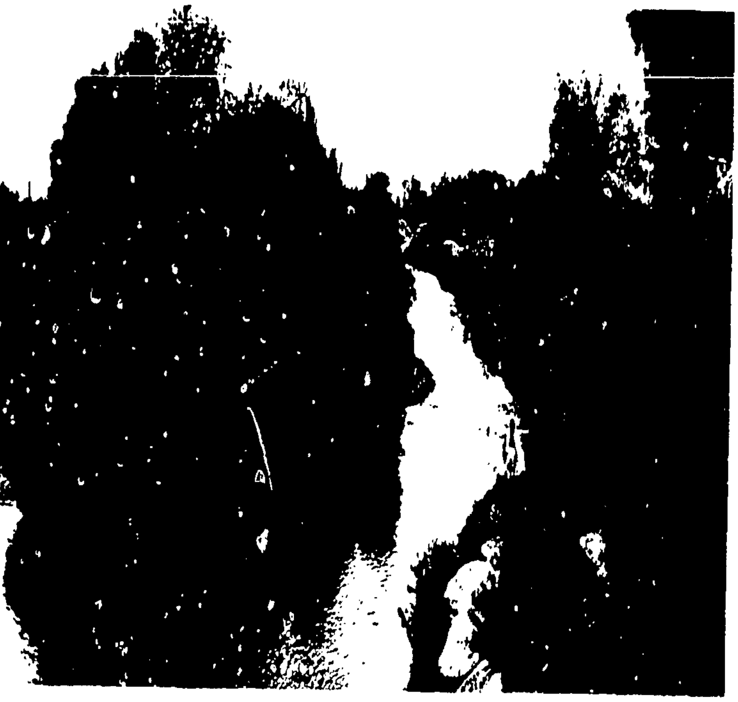
16C

17C

C. GUADALUPE RIVER (Continued)

18C

19C



20C

21C

1D

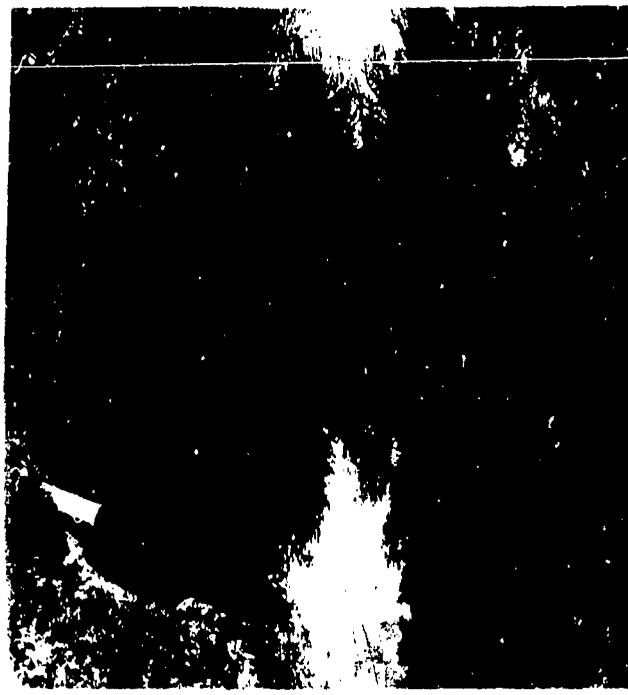
2D

3D

4D

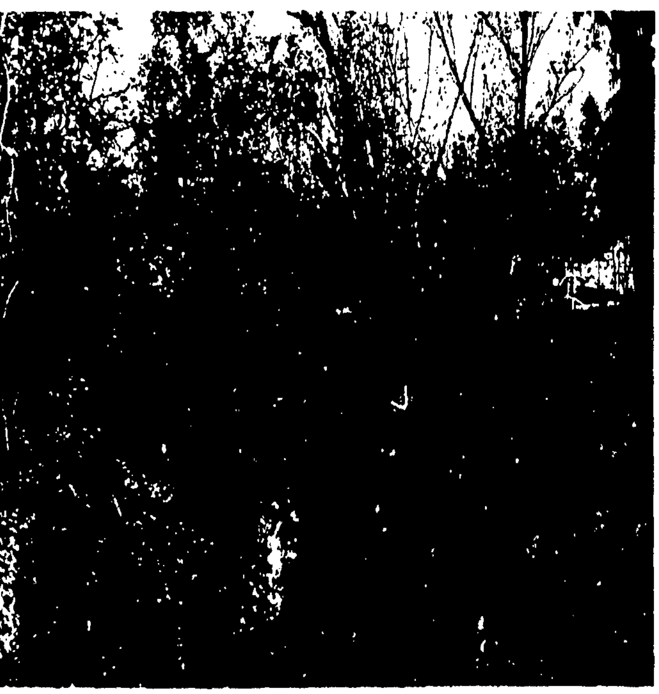
D. COYOTE CREEK (Continued)

5D



6D

9D



10D

7D

8D

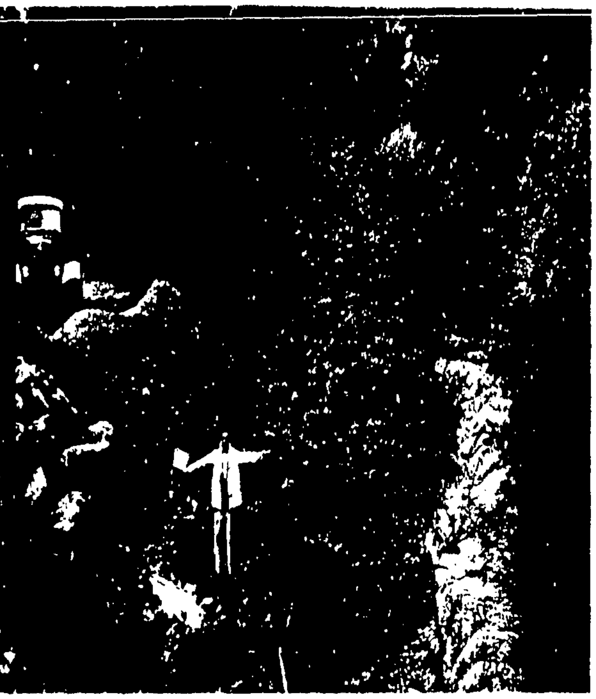
11D

12D

E. PENITENCIA CREEK

1E

2E



5E

6E

3E

4E

7E

8E

APPENDIX E

PUBLIC SCHOOL GROUNDS OF SAN JOSE FOR PASSIVE PROTECTION WITHIN THE COMMUNITY

Introduction

A general mass fire is expected to develop in American communities exposed to the direct effects of a nuclear explosion (out to about 2 psi). And mass fire effects may be a principal cause of loss of life. Within fire-vulnerable buildings and shelters, and outside in highly built-up areas, mass fire may be a direct cause of fatalities from overheating, burning or poisonous gases. With lethal amounts of fallout present, fire and fumes may cause fatalities indirectly by driving people out of shelter and overexposing them to the gamma radiation outside. An aid for avoiding these difficulties is fire-free regions within the built-up community into which people can go to escape the deadly mass fire effects--either going into the open (with no fallout or further attacks) or into a suitable shelter (offering Universal Protection).

Put another way, the mass fire generally expected to result in built-up areas exposed to the direct effects of nuclear attack will tend to drive the inhabitants onto the large incombustible open areas within the community. If those open areas are big enough to bring relief from mass fire effects, they will thereby serve usefully for passive protection (in the absence of fallout or subsequent attacks). And large incombustible open areas are also very favorable sites for future new shelters, because they are uniquely free of the very serious difficulties with shelter access and shelter ventilation which arise from blast and mass-fire effects. Thus suitable open areas also have a future potential for providing far better passive protection.

It is to be noted that the basic need for open space as refuge from mass fire (and other) effects usually exists only well within the built-up and populated area. Near the outer edges of the community there is normally plenty of open space provided by the general surroundings--and much of this may be incombustible. It is the interior oases of incombustibility that we need to search out.

The chief public lands in San Jose of interest as refuges from mass fire, and as sites for future new shelters, are (1) school grounds and (2) parks (and golf courses). This Appendix E will deal with public school grounds. The next, Appendix F, will cover public parks.

Public Schools in San Jose

To inventory the space on existing public school grounds suitable for passive protection it was necessary to contact 10 different School Districts and obtain from them, or from their schools, or from the designing architects, plot plans for over 100 different installations. Where necessary, field inspections were made to clarify points of uncertainty and to ascertain the nature of the surroundings. These observations were recorded informally on the plot plans.

The locations of the schools are indicated in Figure 22 in the body of this report. Schools are grouped by School Districts, also shown in Figure 22. For each school, then, the area useful for passive protection was delineated within the total available open area according to the following rules for fire barriers:

The area should be (1) 150 ft from one-story dwellings, and (2) 300 ft from two-story dwellings or one-story commercial or industrial buildings. Orchards were treated as equivalents of one-story dwellings.

Areas useful for passive protection have been sketched in roughly on the plot plans and their sizes have been estimated and tabulated. The results appear in Table E-1 which follows.

It seemed impractical to reproduce here all 113 plot plans of useful areas. These are available at SRI, along with record photographs of each school building, for those who need to refer to them. Merely as examples, we will show some of the working drawings of school grounds in the San Jose Unified School District. (Arrows added to these plans indicate the direction in which the photograph was taken.)

Table E-1

AREAS OF SCHOOL GROUNDS USEFUL FOR PASSIVE PROTECTION

SUMMARY TOTALS

	School District	Usable Area Sq Ft
(o)	Collegiate Fields	1,893,000
(1)	Campbell Elementary	1,193,300
(2)	San Jose Unified	3,304,270
(3)	Campbell Union High School	2,811,440
(4)	Moreland Elementary	1,042,300
(5)	Cambrian Elementary	578,800
(6)	Union Elementary	1,998,380
(7)	Alum Rock Union	2,589,500
(8)	Franklin McKinley	590,900
	Total	14,558,890

(o) COLLEGIATE FIELDS

1.	San Jose City College	560,000
2.	S.J.S. Spartan Field	1,324,000
	Total	1,893,000

(1) CAMPBELL ELEMENTARY

1.	Moorpark	231,000
2.	San Tomas	26,000
3.	Hamilton	32,000
4.	Rosemary	50,000
5.	Cypress	70,000
6.	Quito	66,000
7.	Campbell	129,600
8.	Sherman Oaks	105,000
9.	Parkway	71,500
10.	Lynhaven	110,000
11.	Marshall Lane	36,800
12.	Forest Hill	95,200
13.	Rolling Hills	20,000
14.	Capri	80,000
15.	Castlemont	70,200
	Total	1,193,300

(2) SAN JOSE UNIFIED

1.	Allen	12,600
2.	Anne Darling	57,600
3.	Bachrodt	82,500
4.	Bascom	95,200
5.	Belden	12,800
6.	Bouksin	74,300
7.	Canons	43,800

(2) SAN JOSE UNIFIED (continued)

8.	College Park	13,800
9.	Benj. Cory	24,100
10.	Empire Gardens	18,450
11.	Hacienda (off map)	93,800
12.	Hammer	151,500
13.	Lincoln Glen	16,600
14.	River Glen	70,900
15.	Reed	19,200
16.	Schallenbanger	75,575
17.	Simonda	Site
18.	Trace	22,500
19.	Valley View	56,450
20.	Burnett	101,900
21.	Hoover Jr. High	216,000
22.	Willow Glen Senior High Edwin Markham	580,000
23.	John Muir Junior High	92,000
24.	Roosevelt	107,000
25.	Abraham Lincoln High	296,000
26.	Pioneer High	680,000
27.	San Jose High	175,000
27A.	San Jose High 2nd pg.	114,700
	Total	3,304,275

(3) CAMPBELL UNION HIGH SCHOOL

1.	Westmont High School	660,000
2.	Blackford High School	650,000
3.	Del Mar High School	480,000
4.	Camden High School	241,440
5.	Leigh High School	555,000
6.	Campbell High School	225,000
	Total	2,811,440

(4) MORELAND ELEMENTARY

1.	Moreland	0
2.	El Quito	91,000
3.	Bucknall	45,000
4.	Strawberry Park	90,000
5.	Elvira Castro Junior High	194,000
6.	Country Lane	62,000
7.	Amber	8,800
8.	Latimer	20,000
9.	Payne	40,000
10.	Easterbrook	38,000
11.	Curtis Rogers Junior High	240,000
12.	Coventry	57,000
13.	Gussie M. Baker	48,000
14.	Anderson	48,000
15.	-	-
16.	Brookview	60,500
17.	Phelan	0
	Total	1,042,300

(5) CAMBRIAN ELEMENTARY

1.	Cambrian	31,400
2.	Steindorf	119,500
3.	Ida Price	216,000
4.	Fammatre	37,600
5.	Sartorette	56,000
6.	Bagby	38,400

(5) CAMBRIAN ELEMENTARY (continued)

7.	Farnham	38,400
8.	Bohnett	41,500
	Total	578,800

(6) UNION ELEMENTARY

1.	Carlton Avenue	50,688
2.	Parker Elementary	50,400
3.	Edwin Ostar	88,400
4.	Ross Elementary	112,000
5.	Athenour	180,000
6.	Idella Lietz	106,000
7.	Dartmouth	452,000
8.	Vineland	2,800
9.	Cinnabar	126,000
10.	R.E. Noddin	131,000
11.	Mir Assou	30,000
12.	Hawes	94,000
13.	Alta Vista	72,000
14.	Union	232,000
15.	J. DeVoss	97,400
16.	Lone Hills	33,700
	Total	1,998,388

(7) ALUM ROCK UNION

1.	Overfelt High School	625,000
2.	James Lick High School	425,000

(7) ALUM ROCK UNION (continued)

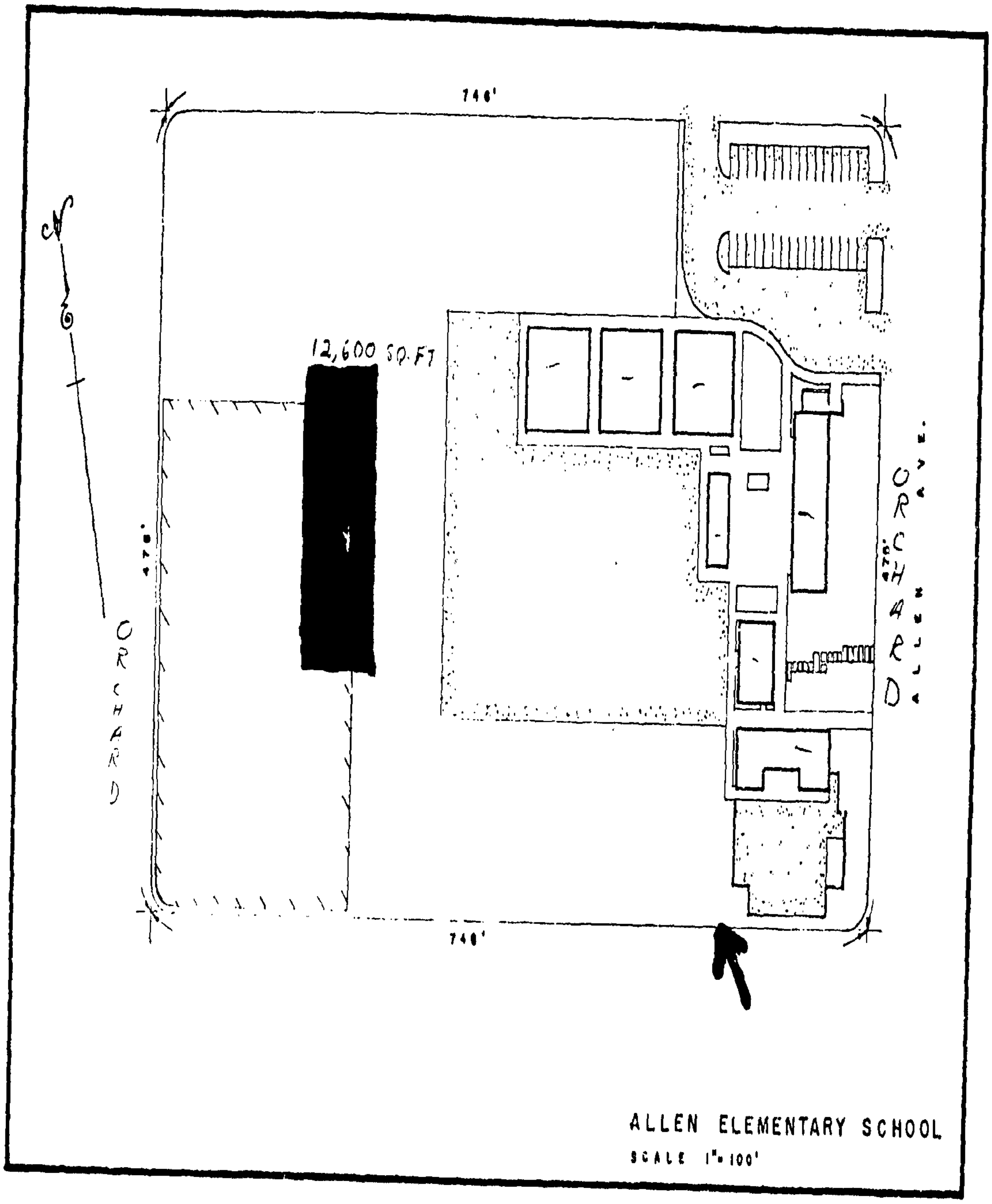
Elementary Schools

1.	Sylvin Cassell	135,000
2.	Richard Conniff	36,000
3.	Dorsa School	27,500
4.	Clyde Fischer	370,000
5.	Horace Cureton	106,000
6.	O.S. Hubbard	110,000
7.	Lyndale School	15,000
8.	Lee Mathson	320,000
9.	Millard McCullam	60,000
10.	Ocala School	270,000
11.	Ben Painter	90,000
	Total	2,589,500

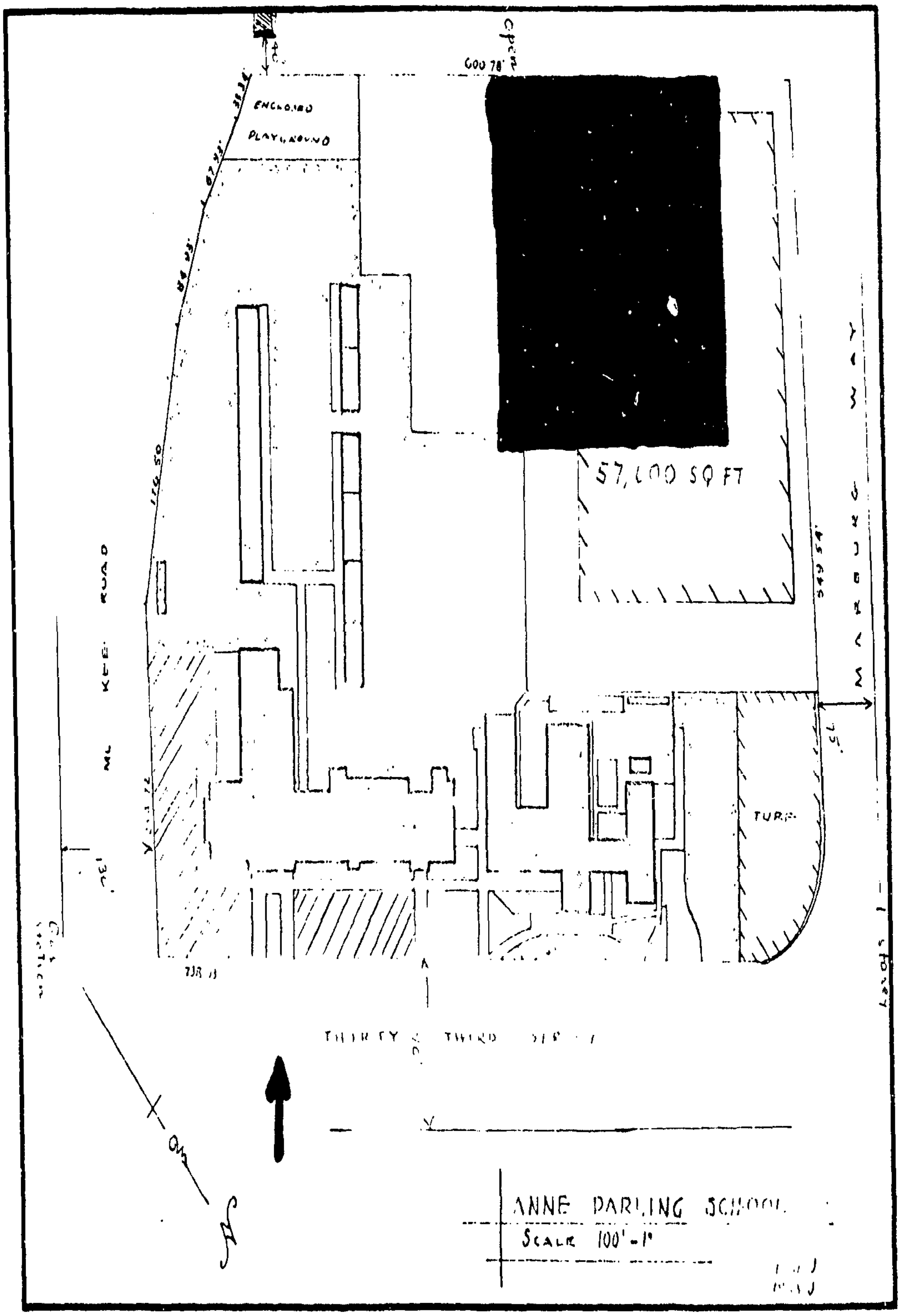
(8) FRANKLIN McKINLEY

1.	McKinley	72,100
2.	Hillsdale	12,600
3.	Franklin	67,000
4.	Sylvandale	160,000
5.	Hellyer	39,200
6.	Santee	33,500
7.	Seven Trees	40,500
8.	Los Arubles	Site
9.	Andrew Hill High School	166,000
	Total	590,900

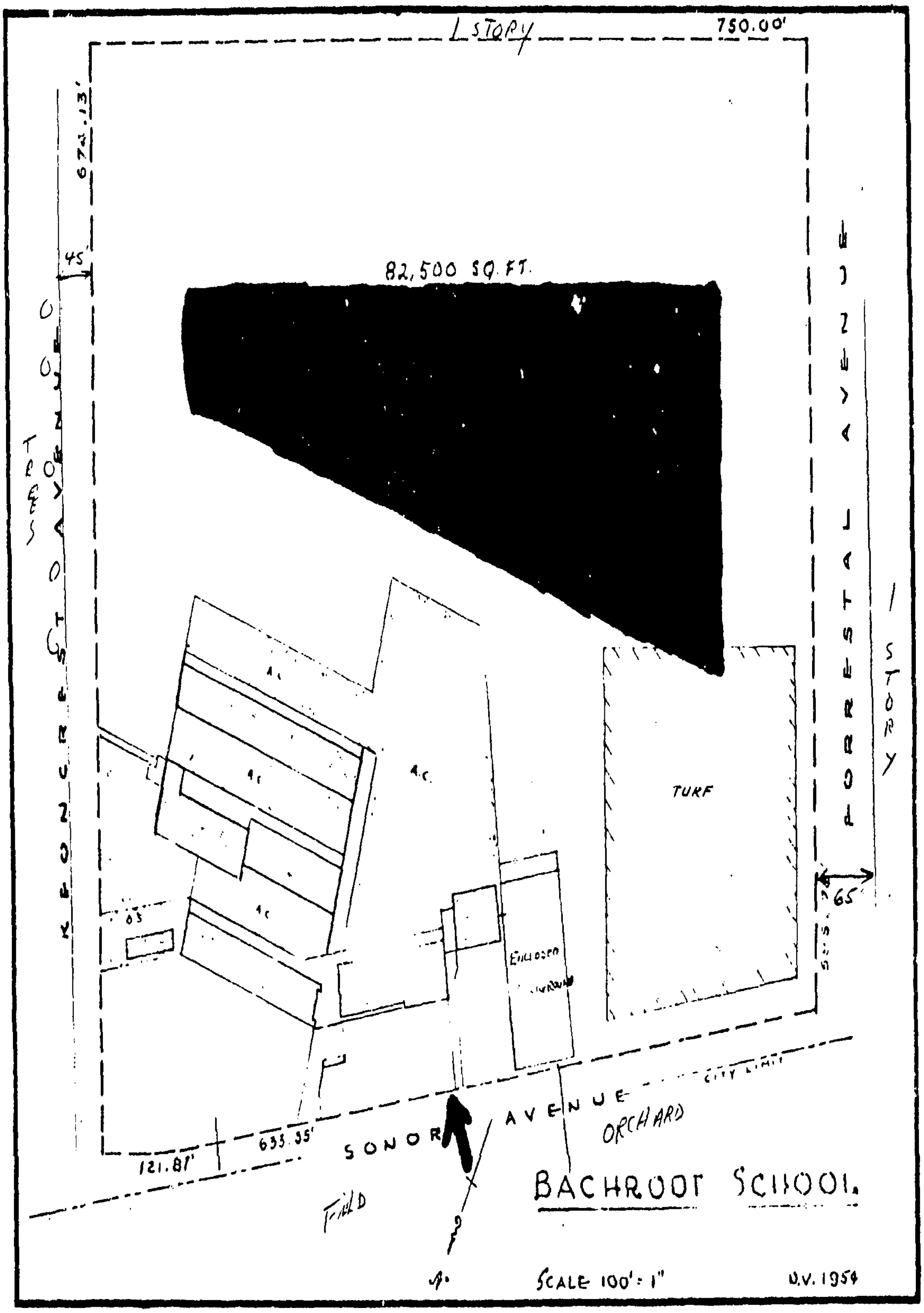
1. ALLEN ELEMENTARY SCHOOL



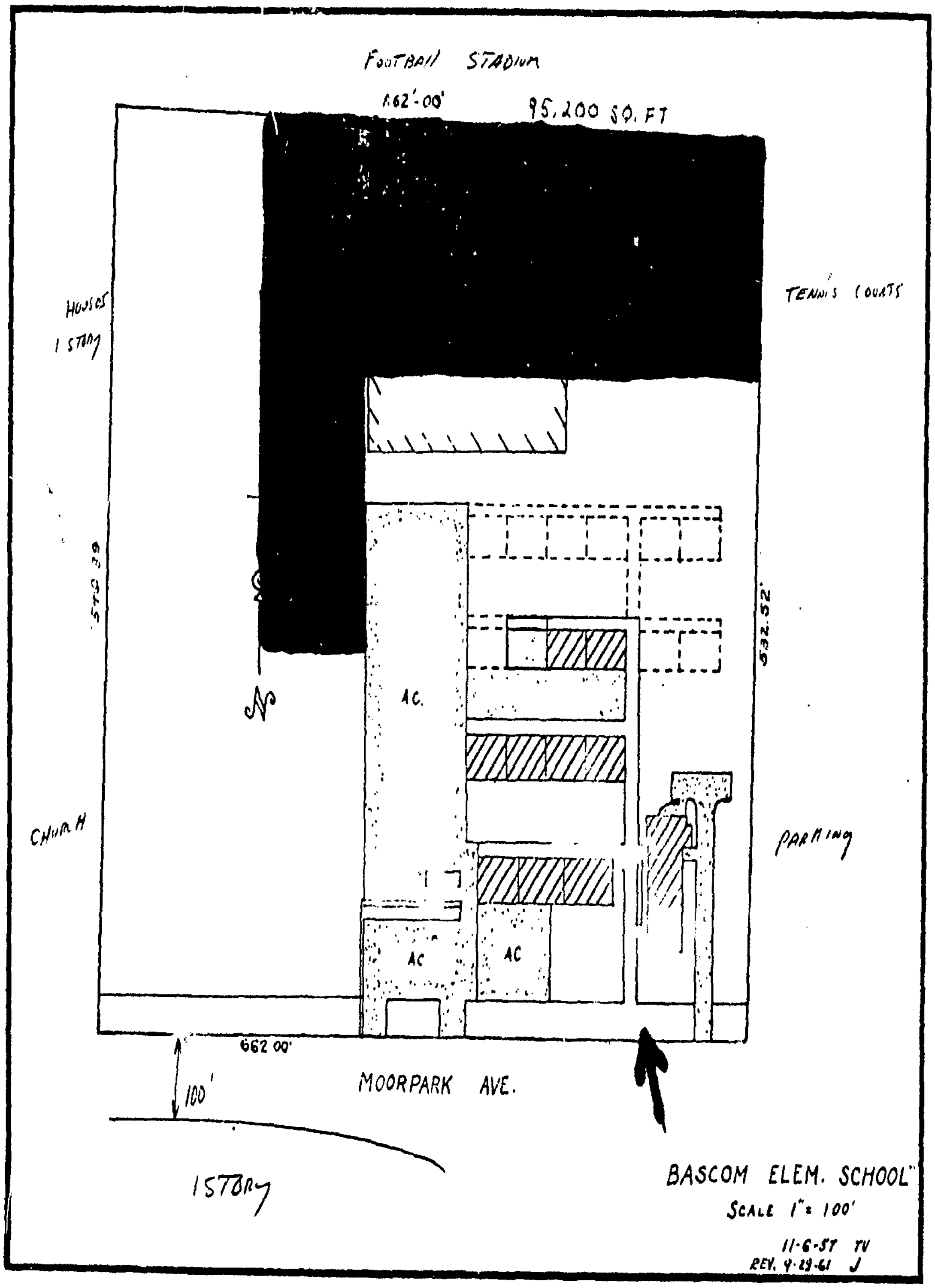
2. ANNE DARLING ELEMENTARY SCHOOL



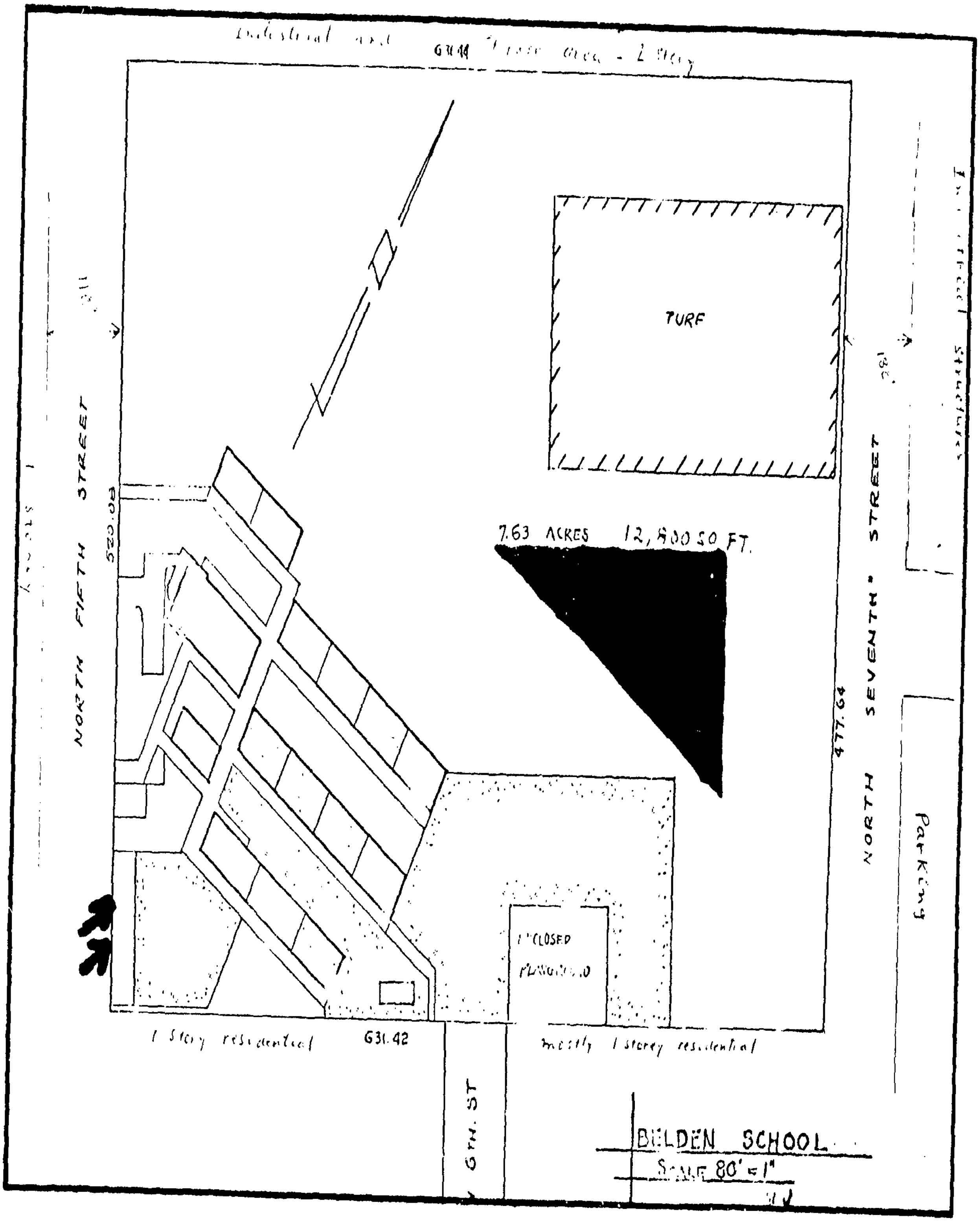
3. WALTER BACHRODT ELEMENTARY SCHOOL



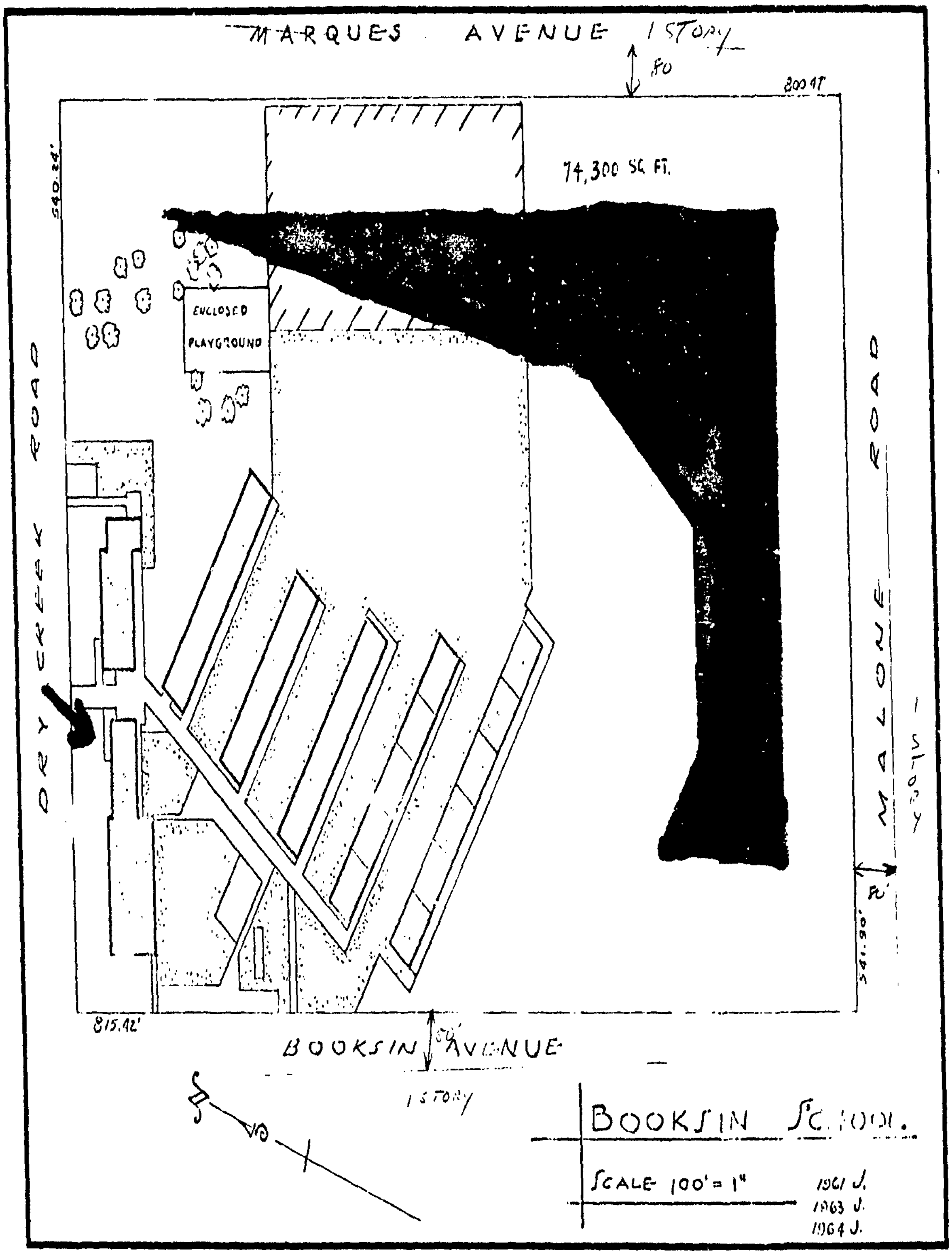
4. BASCOM ELEMENTARY SCHOOL



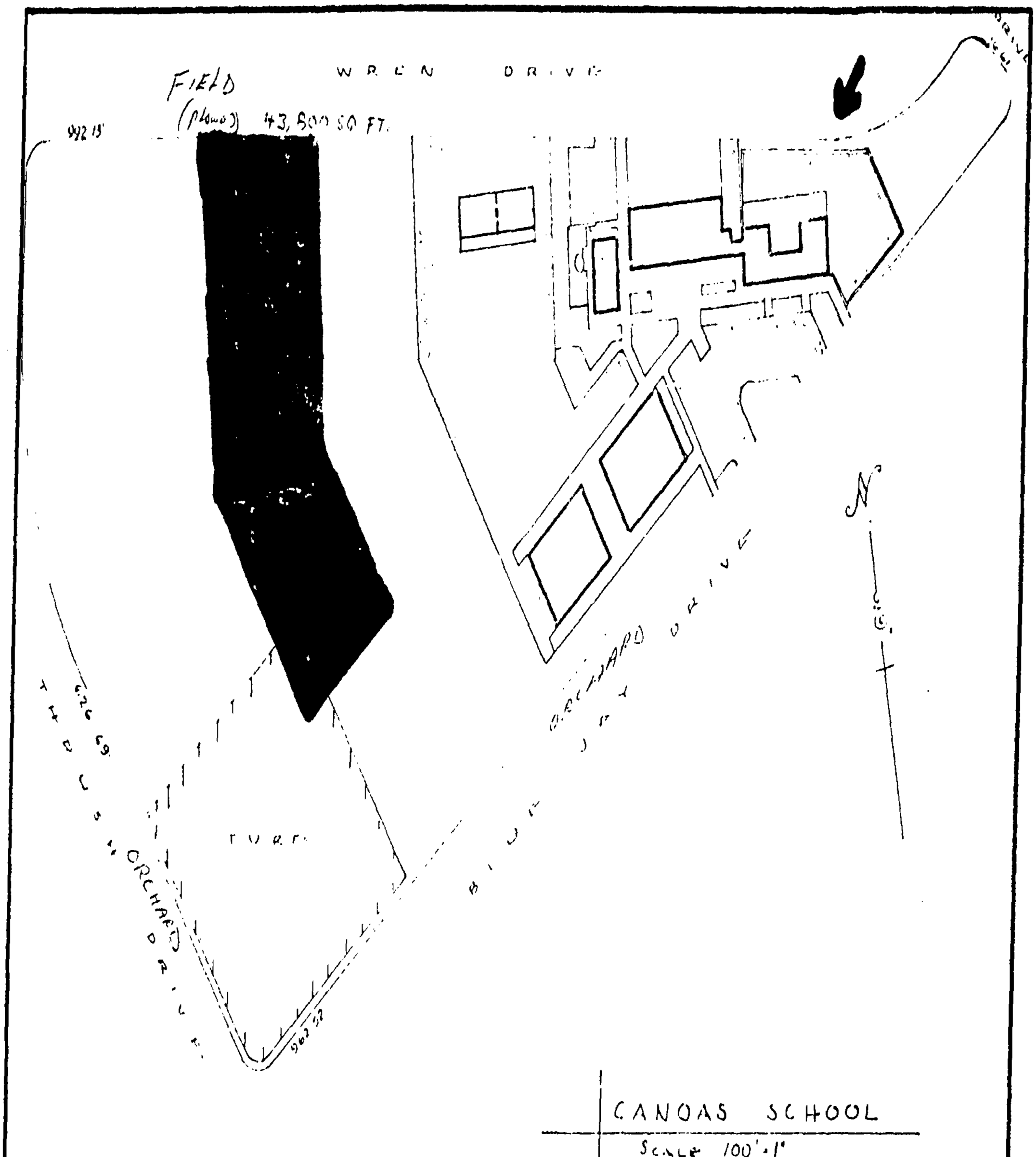
5. BELDEN ELEMENTARY SCHOOL



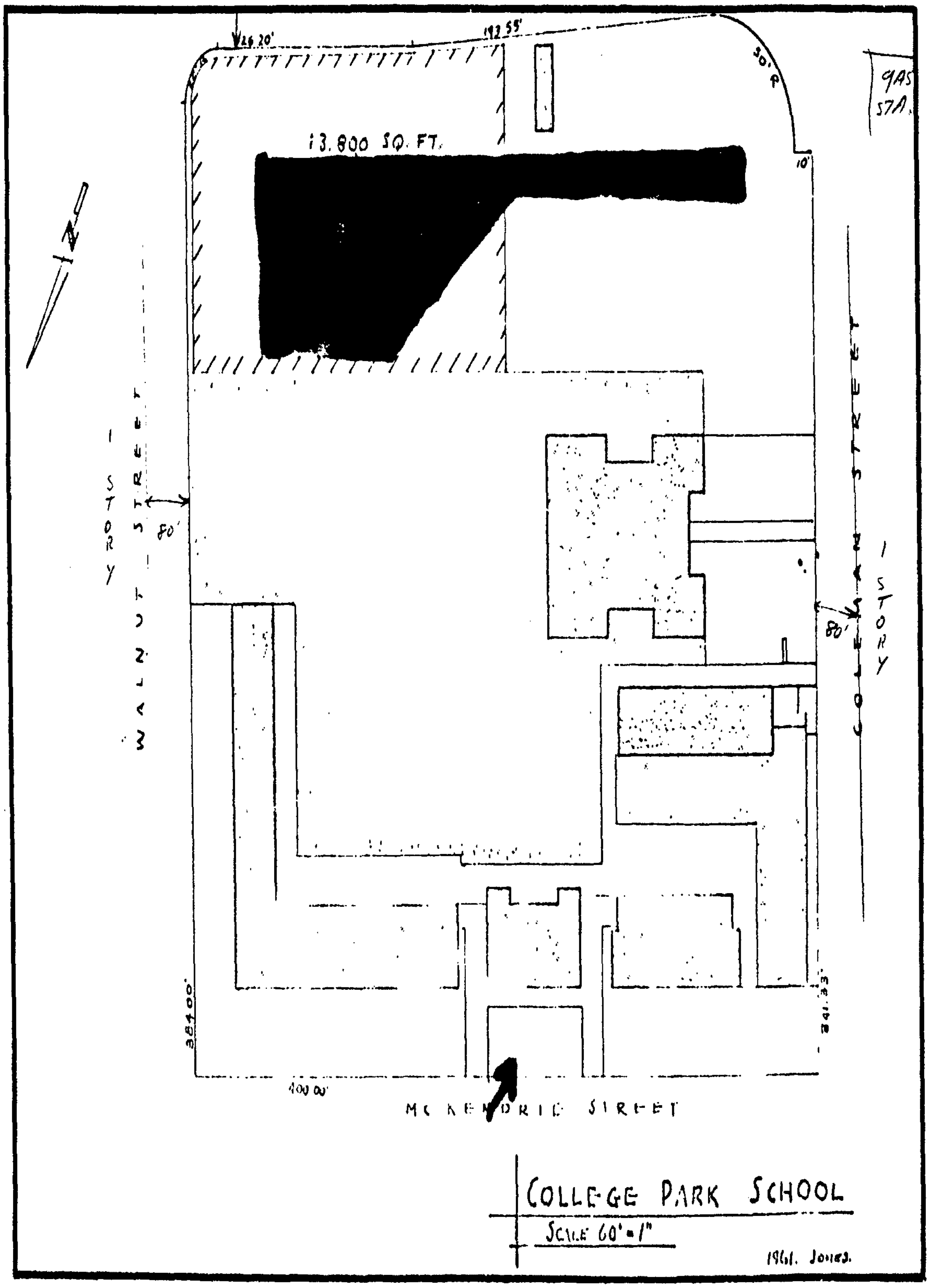
6. BOOKSIN ELEMENTARY SCHOOL



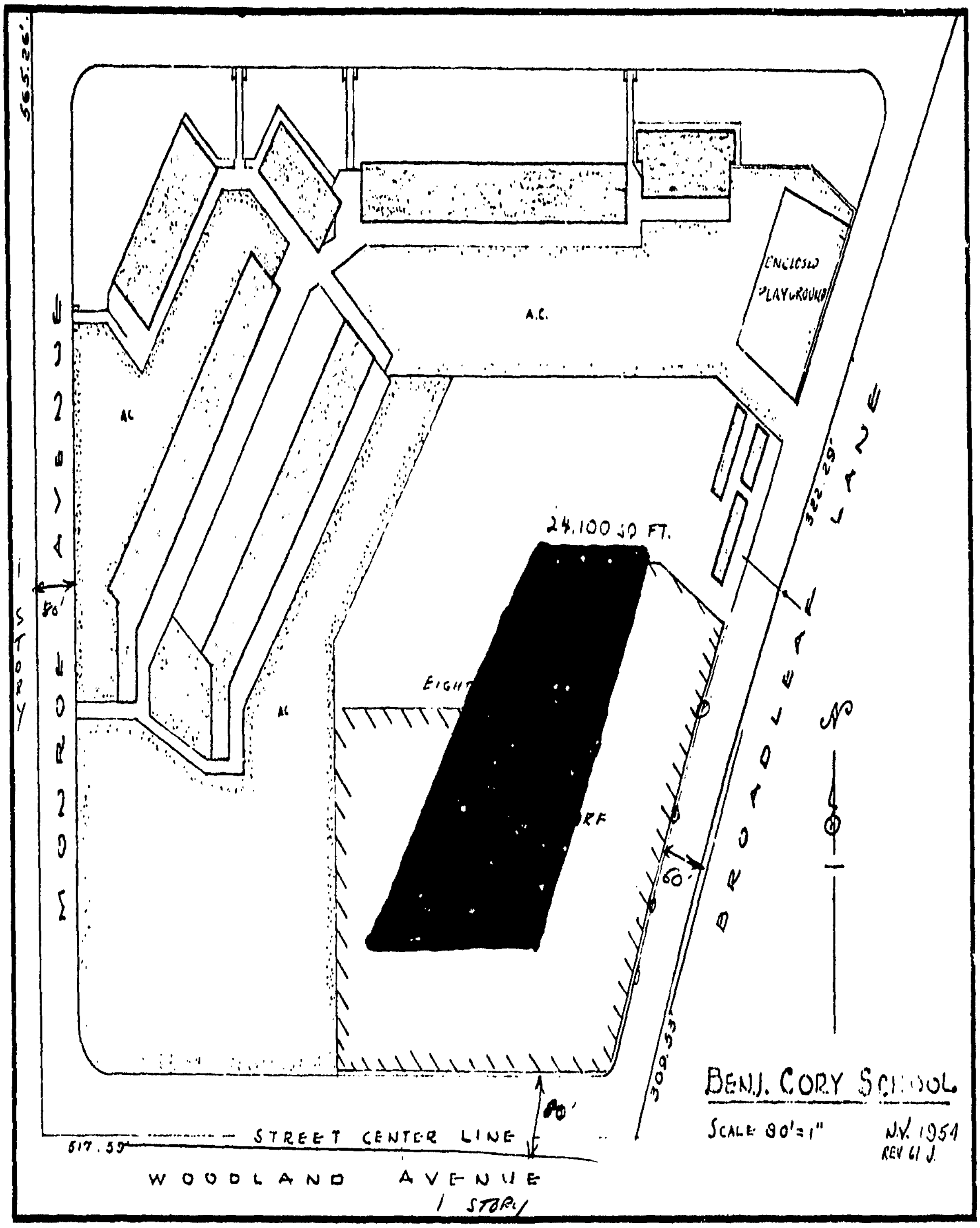
7. CANOAS ELEMENTARY SCHOOL



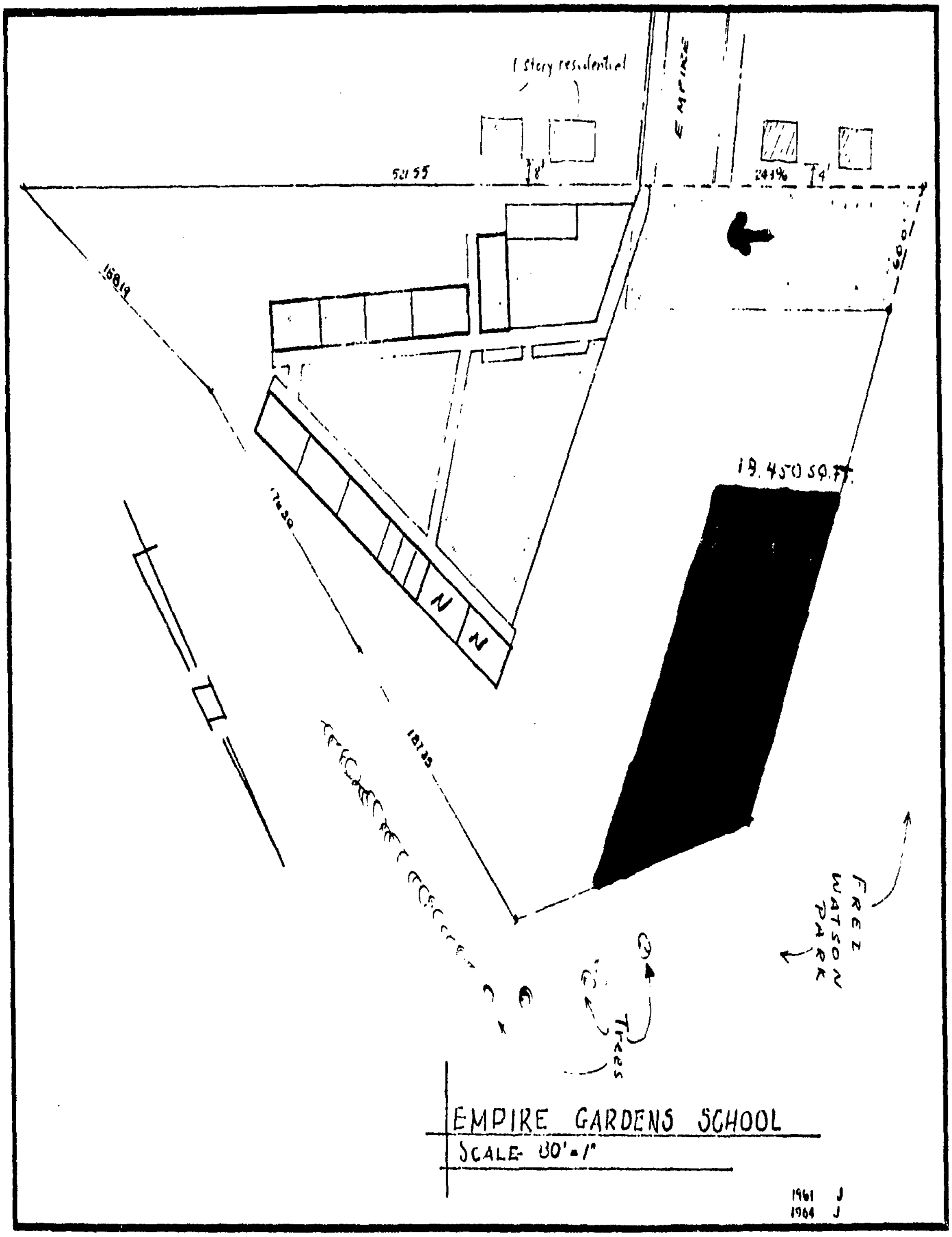
8. COLLEGE PARK ELEMENTARY SCHOOL



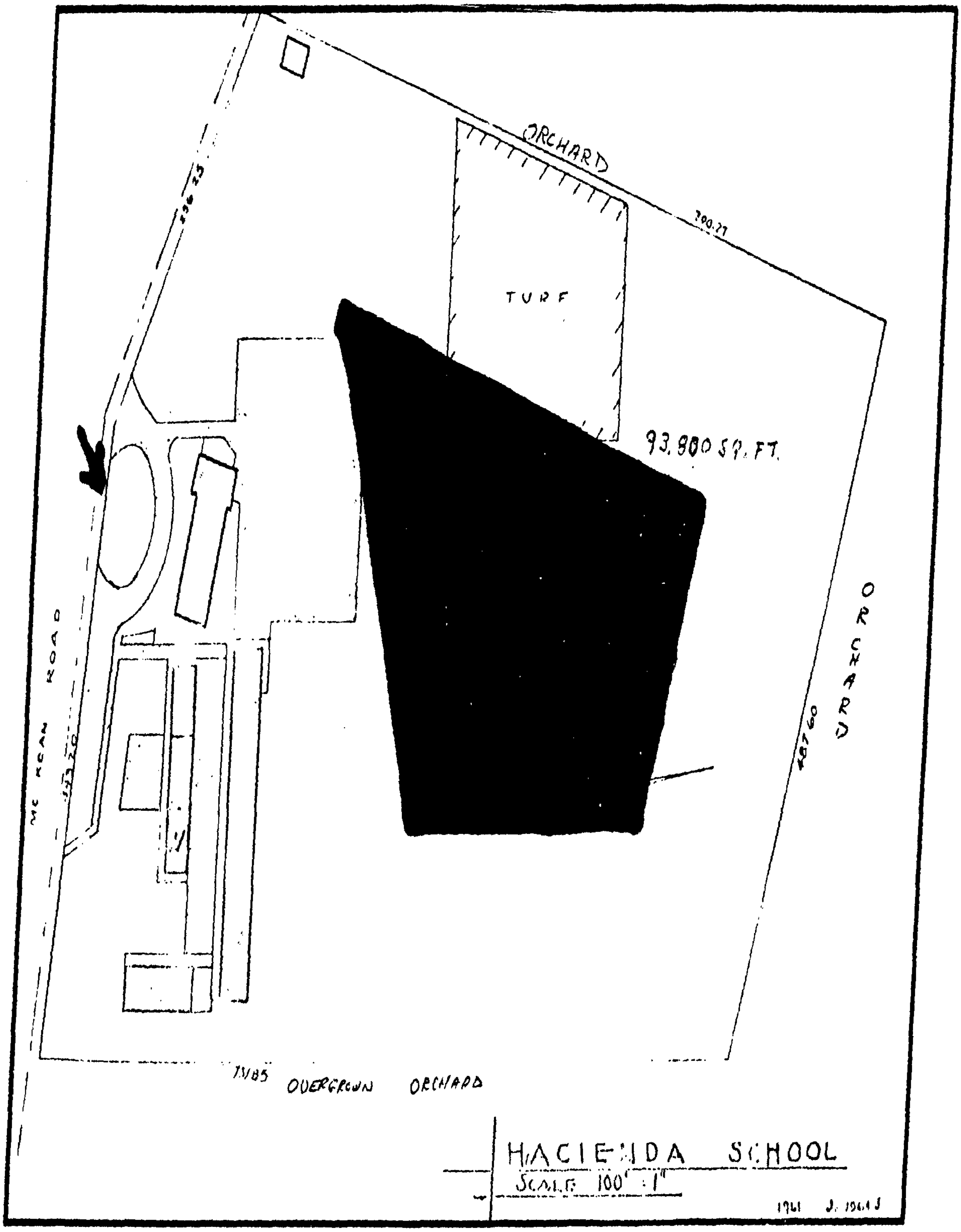
9. BENJAMIN CORY ELEMENTARY SCHOOL



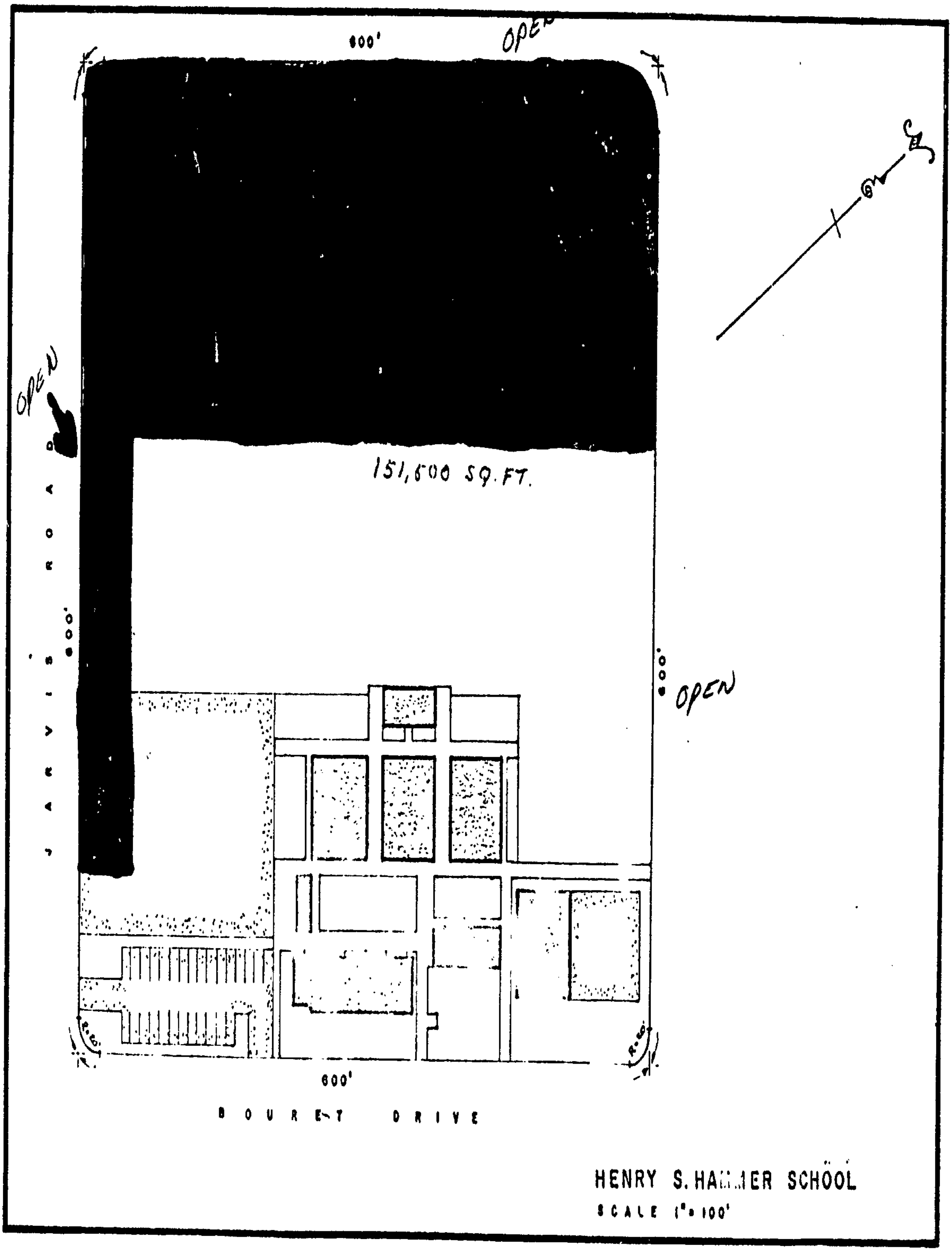
10. EMPIRE GARDENS ELEMENTARY SCHOOL



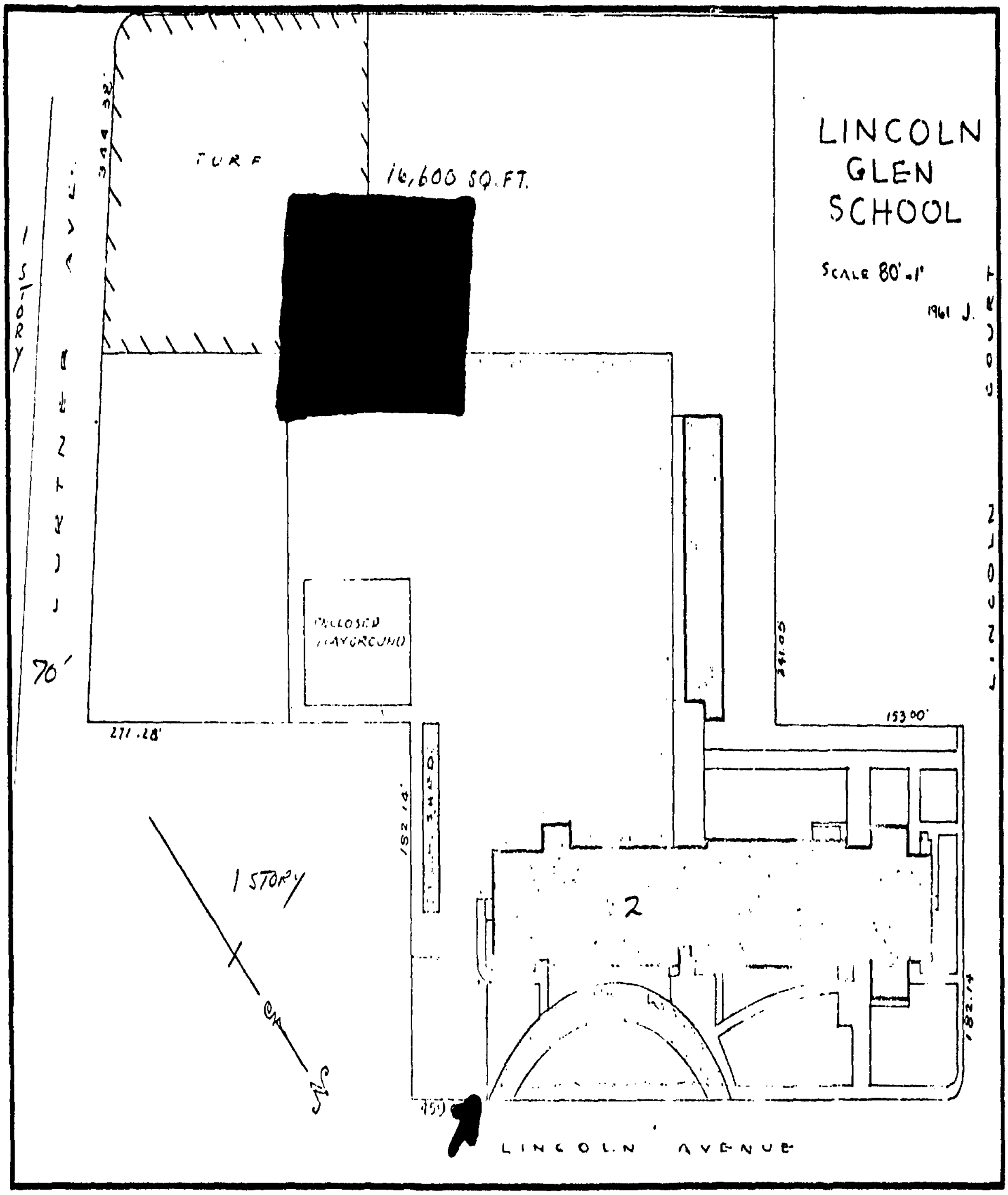
11. HACIENDA ELEMENTARY SCHOOL

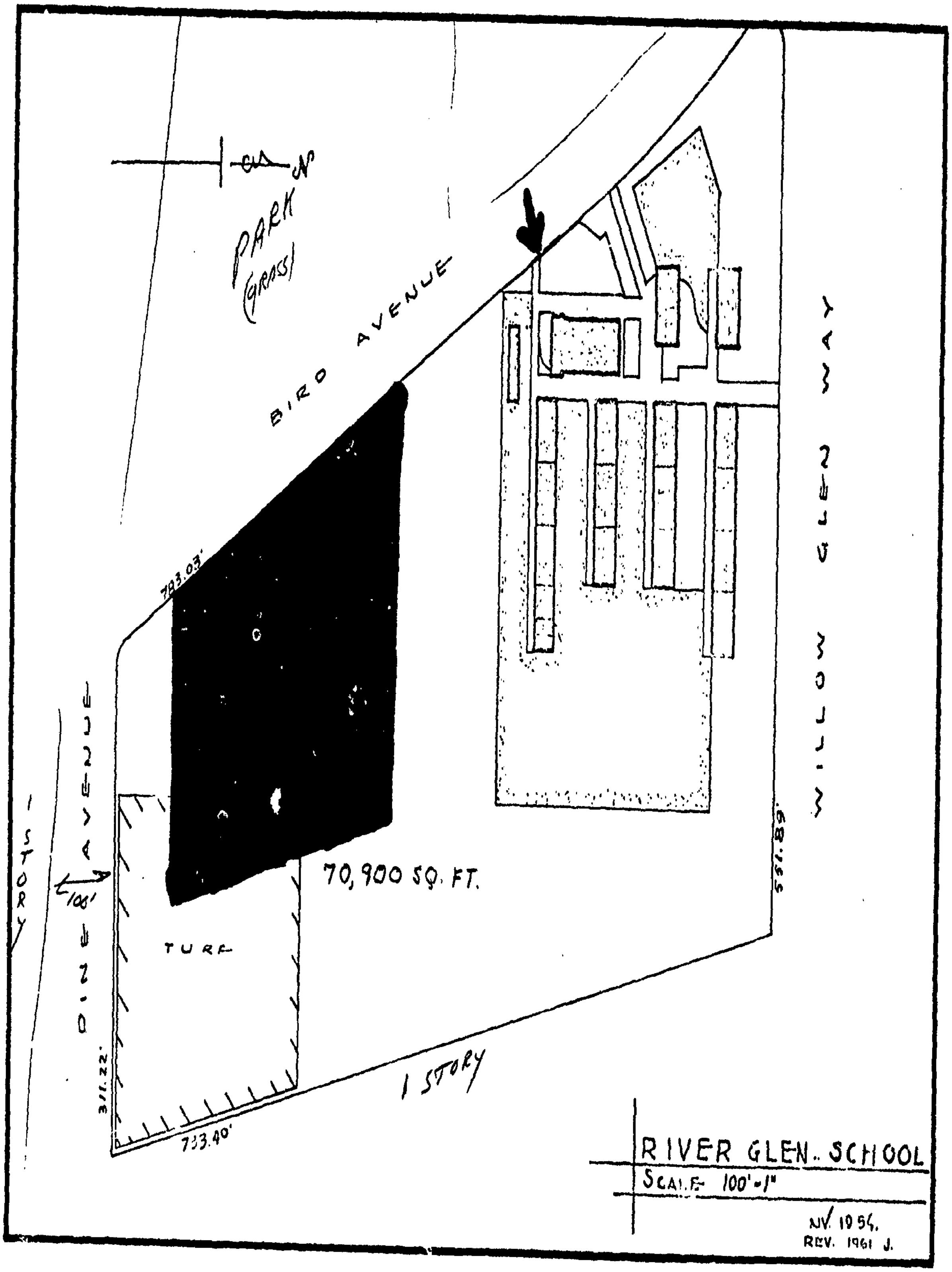


12. HENRY S. HAMMER ELEMENTARY SCHOOL

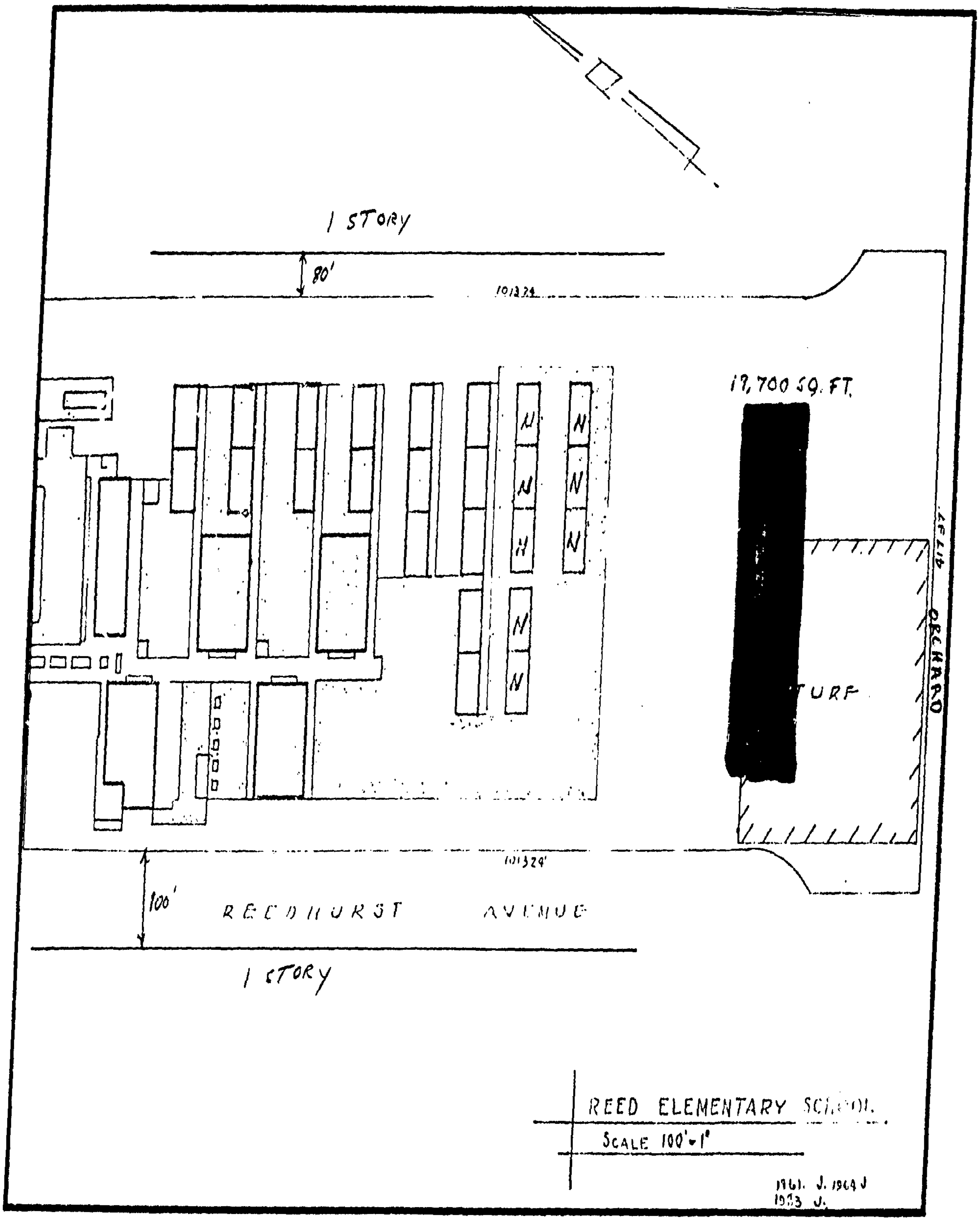


13. LINCOLN GLEN ELEMENTARY SCHOOL

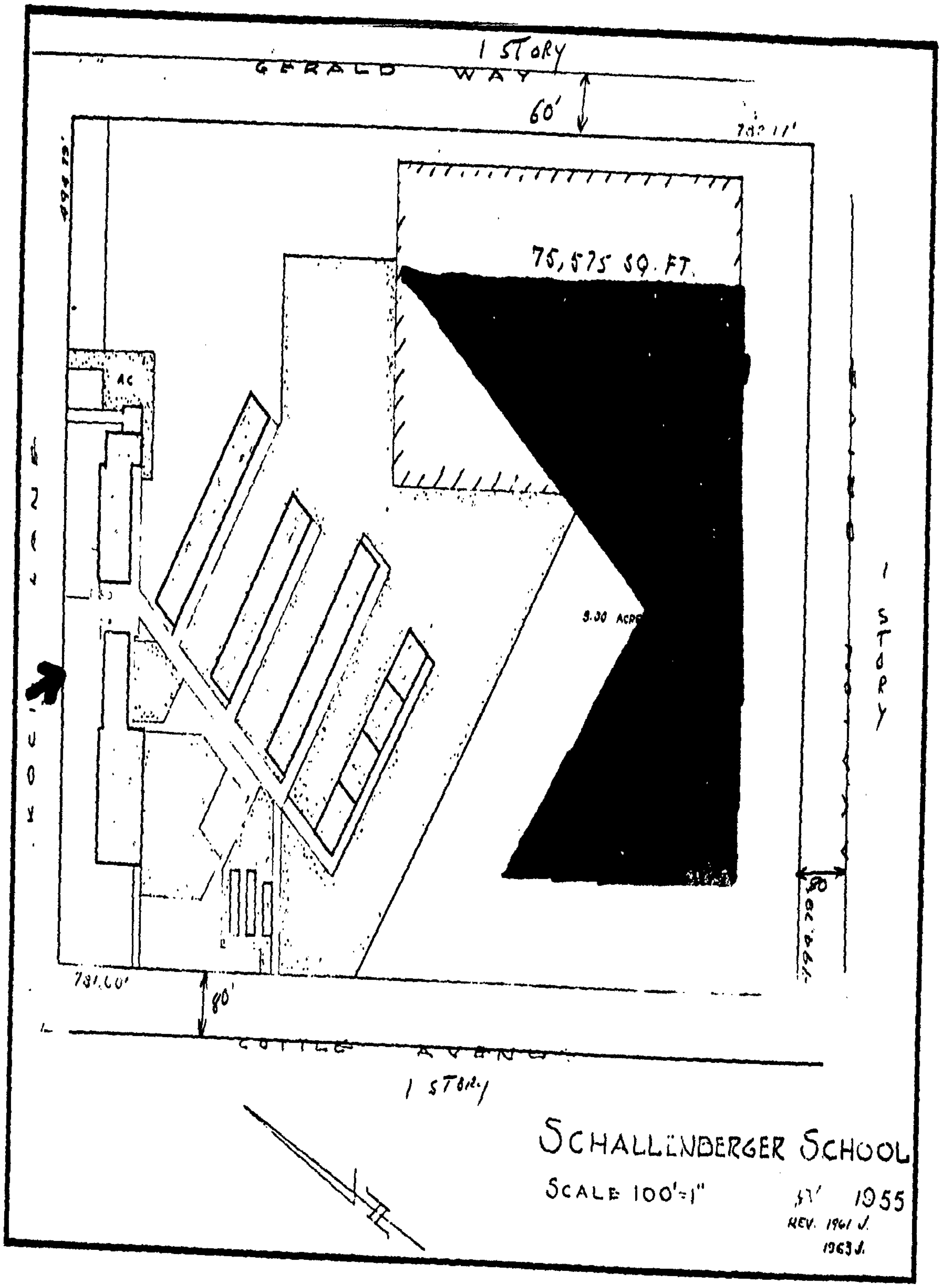



PARK
(GRASS)
BIRD AVENUE
WILLOW GLEN WAY
AVENUE
1 STORY
100'
793.03'
70,900 SQ. FT.
TURF
551.89'
311.22'
733.40'
1 STORY
RIVER GLEN SCHOOL
SCALE 100'=1"
NV. 1956.
REV. 1961 J.

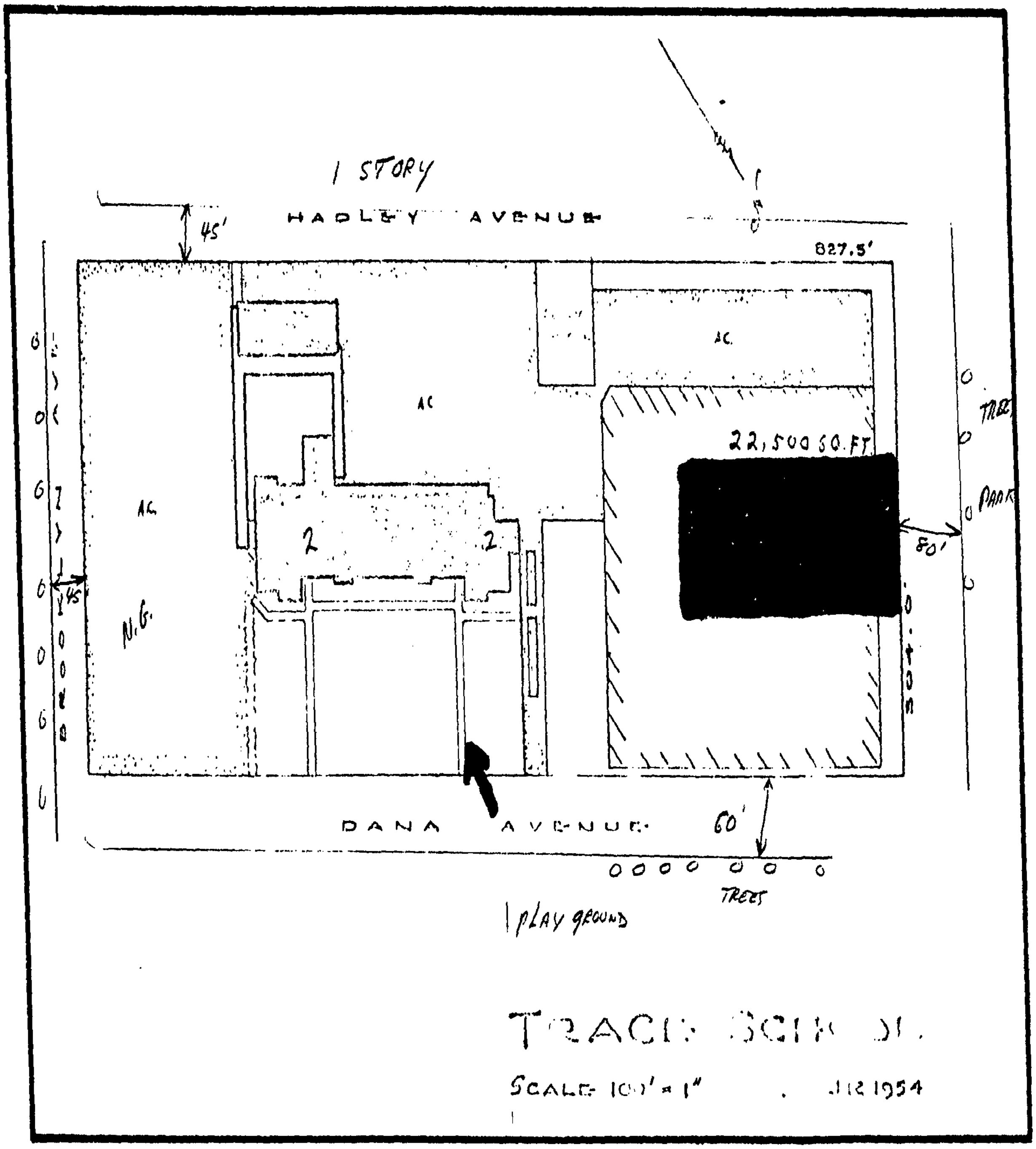
15. REED ELEMENTARY SCHOOL



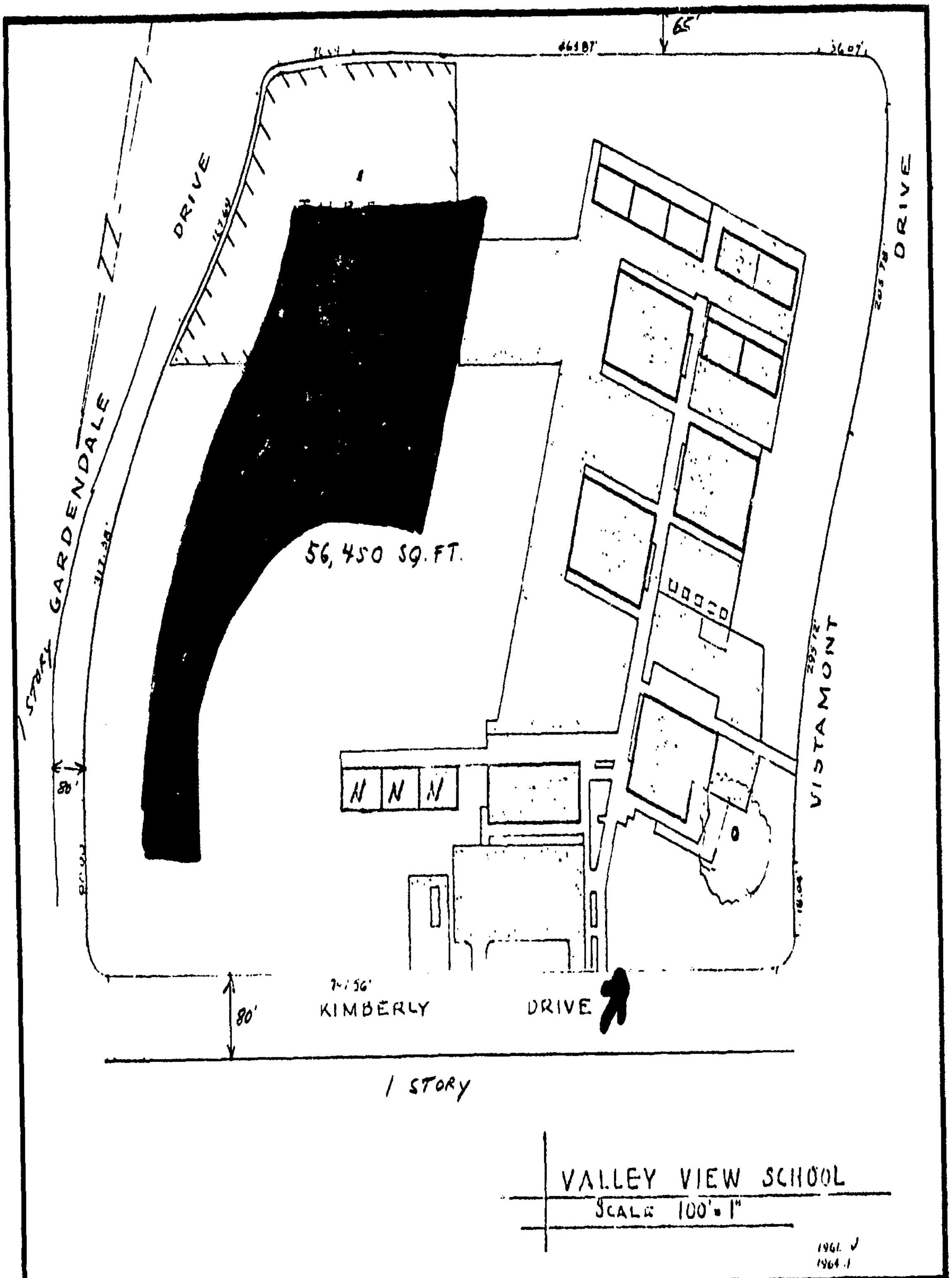
16. SCHALLENBERGER ELEMENTARY SCHOOL



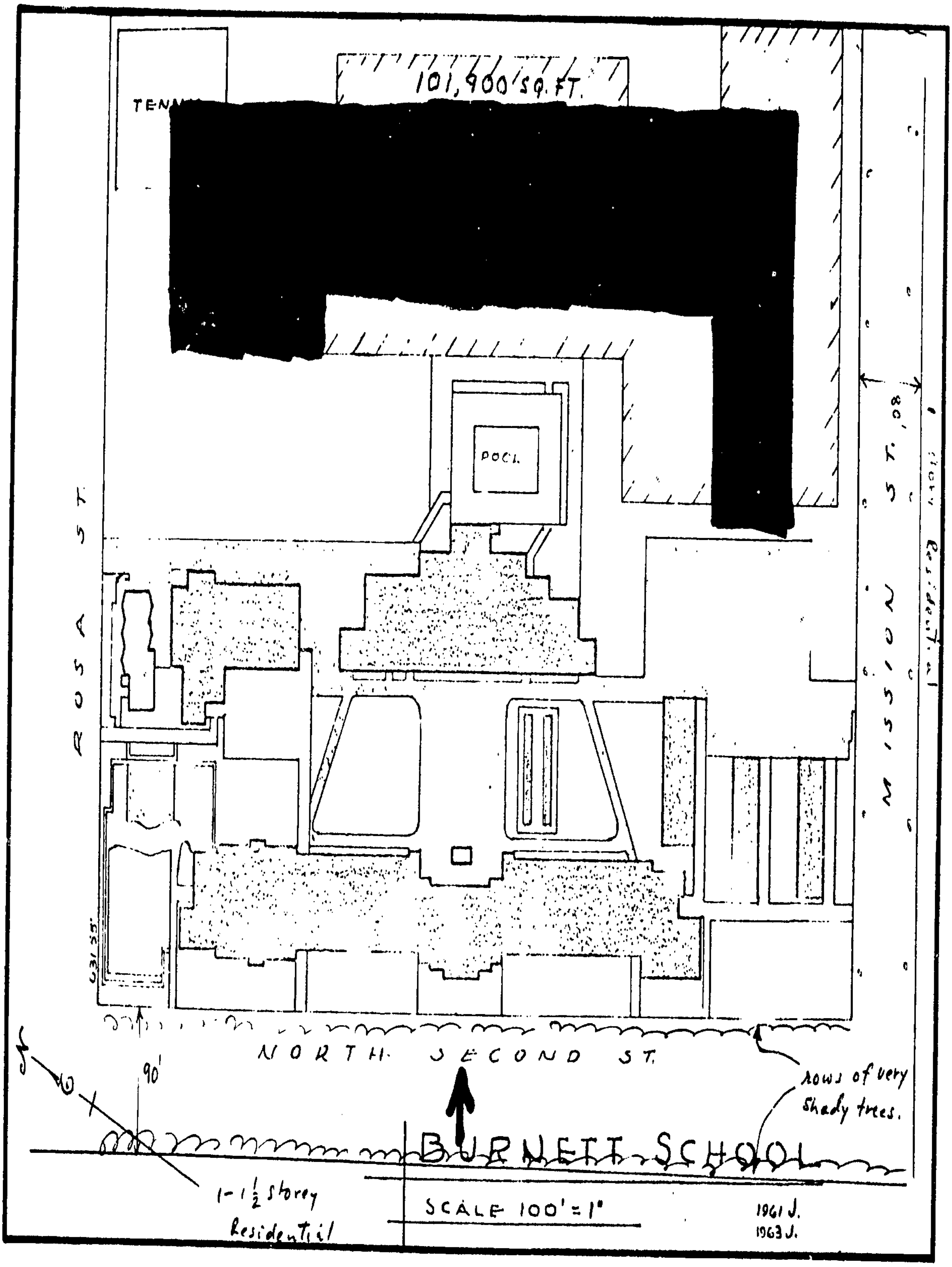
18. TRACE ELEMENTARY SCHOOL



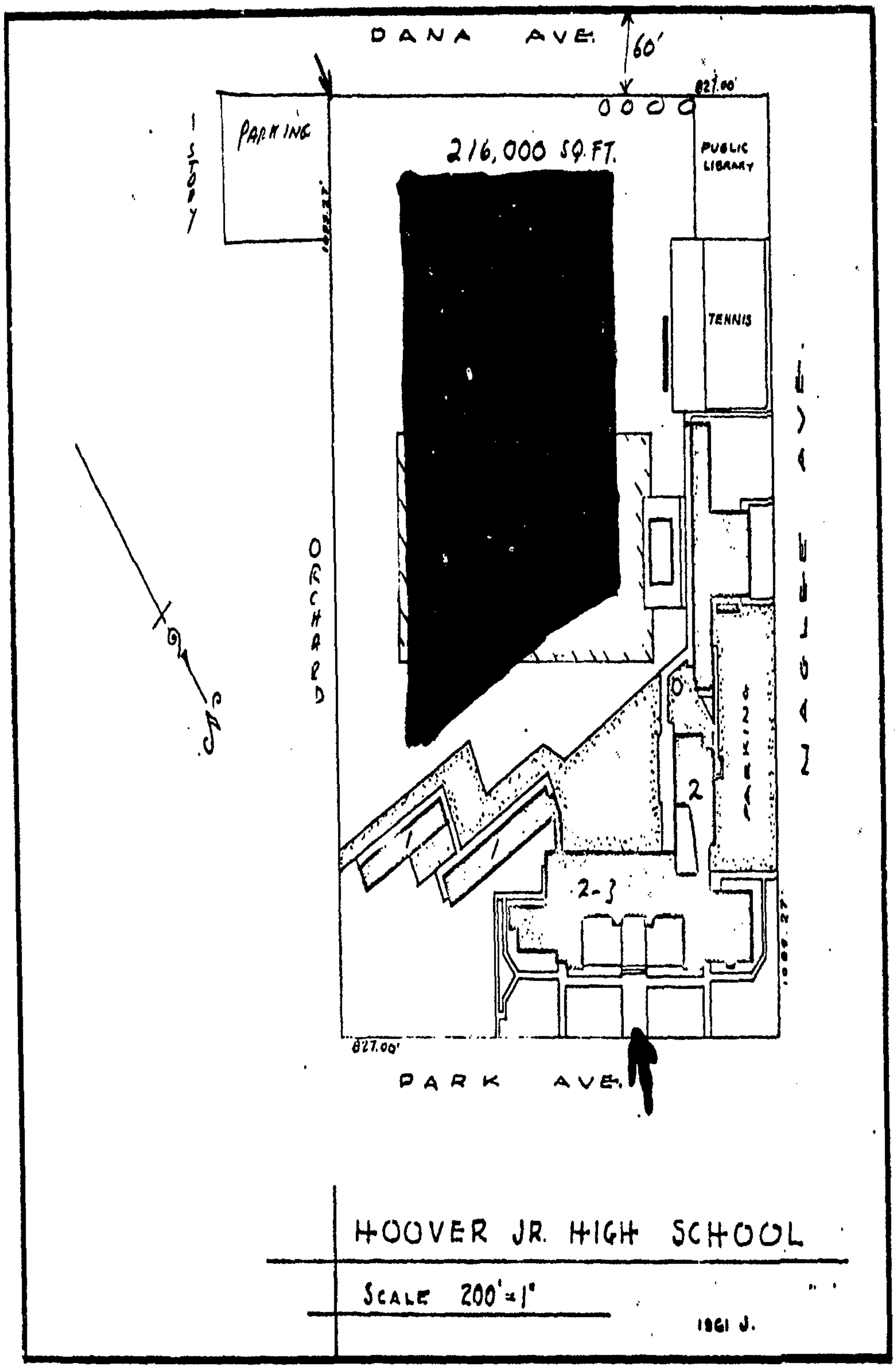
19. VALLEY VIEW ELEMENTARY SCHOOL



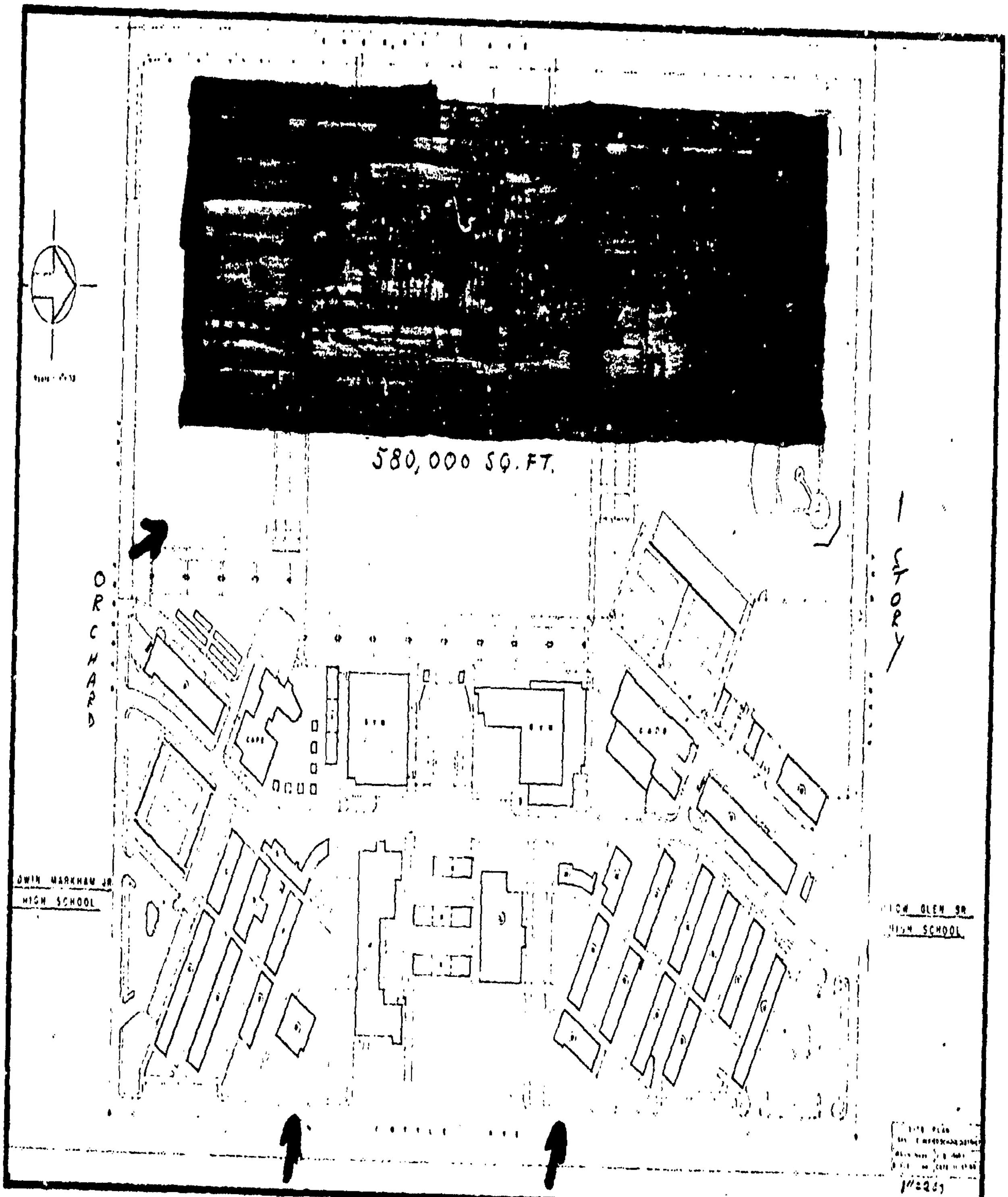
20. PETER H. BURNETT JUNIOR HIGH SCHOOL



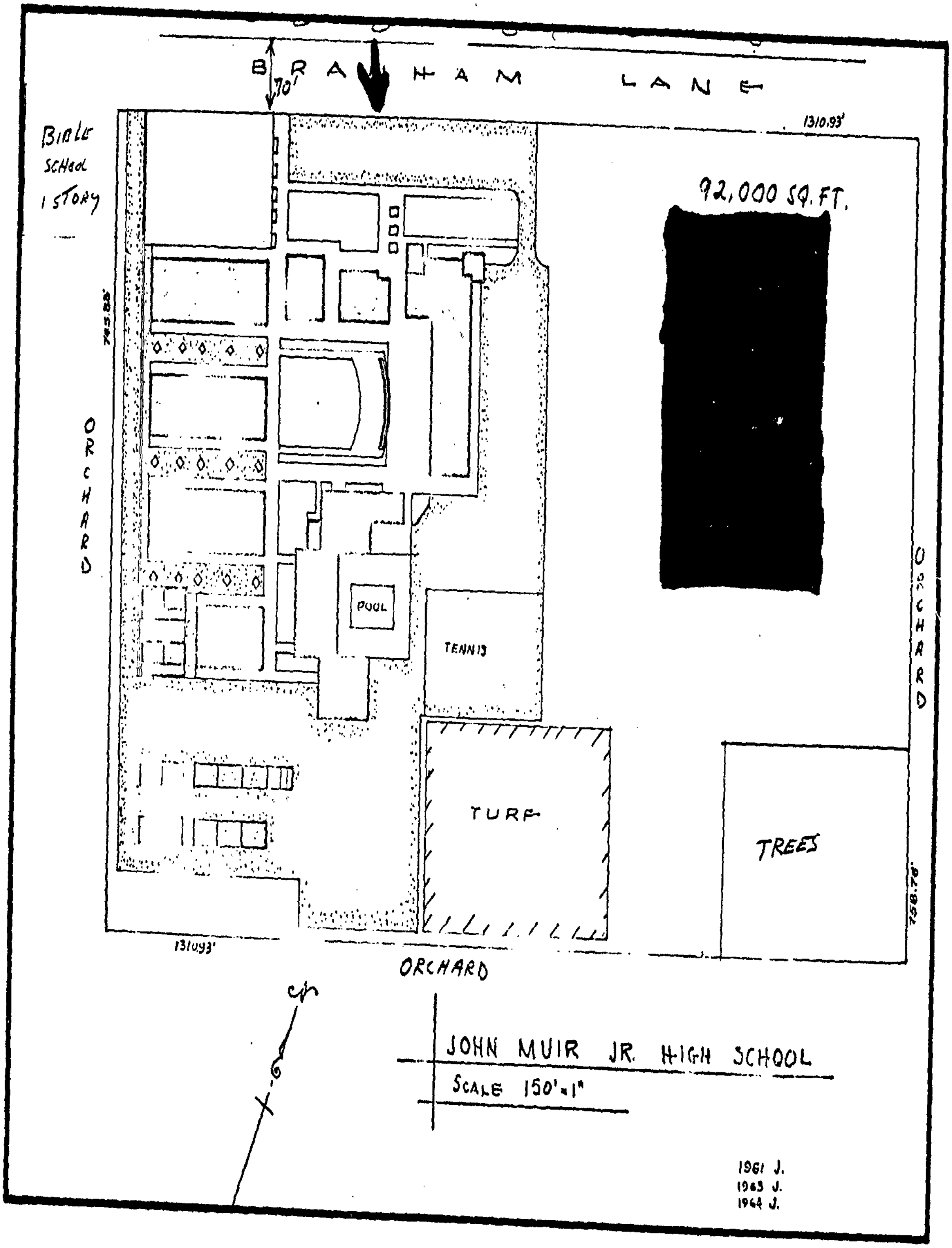
21. HOOVER JUNIOR HIGH SCHOOL



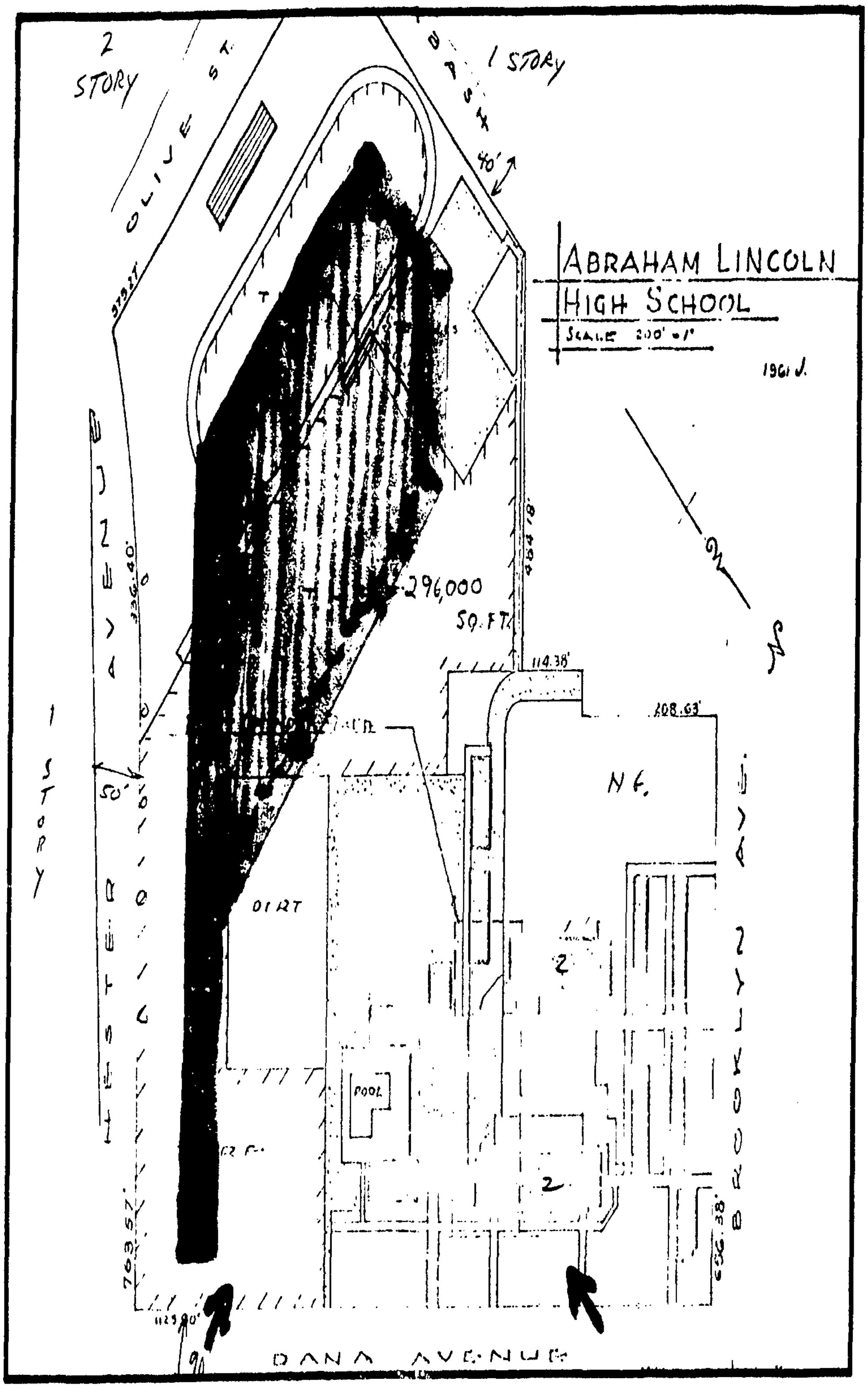
22. EDWIN MARKHAM JUNIOR HIGH SCHOOL
WILLOW GLEN SENIOR HIGH SCHOOL



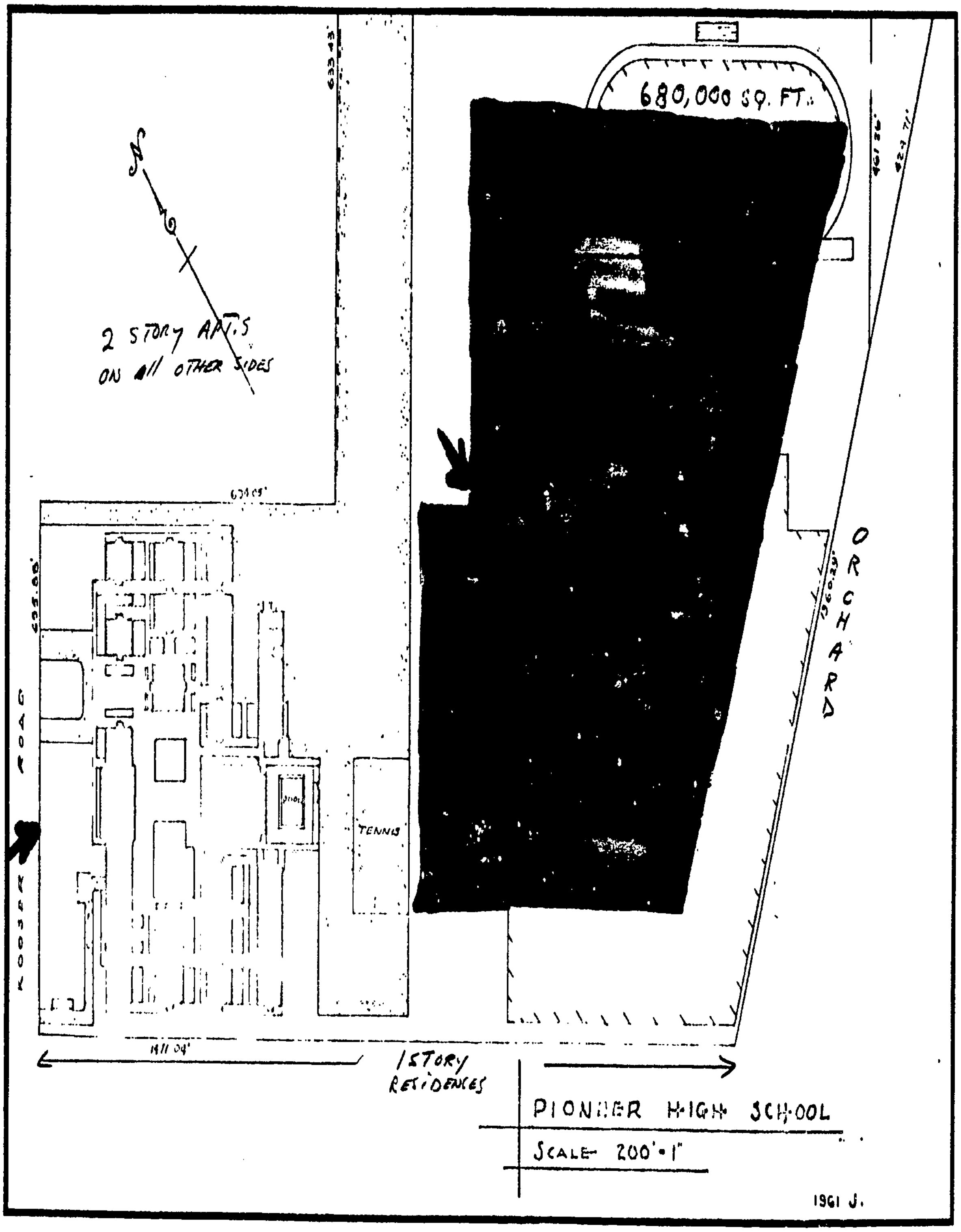
23. JOHN MUIR JUNIOR HIGH SCHOOL



25. ABRAHAM LINCOLN SENIOR HIGH SCHOOL



26. PIONEER SENIOR HIGH SCHOOL



APPENDIX F

PARKS OF THE CITY OF SAN JOSE FOR PASSIVE PROTECTION WITHIN THE COMMUNITY

Introduction

See Appendix E.

City Parks and Golf Courses in San Jose

A list of the 48 City Parks was obtained from the San Jose City Recreation Department. A map of their locations appears in the body of this report as Figure 23. A plan for each of these parks was provided by the San Jose City Planning Commission. Those plans give the details of the type and locations of structures, lakes, trees and shrubs. These detailed park plans proved to be very convenient for estimating the area usable for passive protection (from mass fire).

To find the usable area, a clear space around every combustible item--including the park surroundings--was allowed according to the following schedule:

Combustible Item	Width of Clear Space
Row or small group of small shrubs	10 ft.
Row or small group of small trees or large shrubs	30 ft.
Row or small group of large trees	75 ft.
Orchard or one-story light-residential frame dwelling	150 ft.
One-story commercial or two-story residential buildings	300 ft.

These estimates of clear space barriers necessary to avoid serious fire effects were developed from data in The Effects of Nuclear Weapons* and a report of the Factory Mutual Research Corporation.**

The general procedure is outlined on the "Arroyo Park" plan (which follows) and that scheme may be taken as representative of the treatment given to all the others. The results obtained are heavy black outlines of the usable areas on the original park plans, and estimates of the square footage involved (in the upper-right-hand corners). From these working plans, prints of smaller size have been made. These small reproductions of larger plans are included in the following for those parks having areas usable for passive protection. (These prints are not of report quality, but we could not afford to redraw them. They appear here for the record and for further planning purposes.)

A summary of the useful areas in the parks and golf courses of San Jose is given in Table F-1 overleaf. Estimates for the golf courses came from aerial photographs and/or visits to the sites.

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* Samuel Glasstone, ed., The Effects of Nuclear Weapons, 1964.

** J.B. Smith, E.W. Cousins and R.M. Newman, Fire Hazard to Fallout Shelter Occupants: A Classification Guide, Factory Mutual Research Corp., for the Office of Civil Defense, 3 April 1964.

Table F-1

AREAS OF PARKS AND GOLF COURSES USEFUL FOR PASSIVE PROTECTION

City of San Jose Parks	Gross Acres	Usable Total Area 1000 sq ft	Remarks	City of San Jose Parks	Gross Acres	Usable Total Area 1000 sq ft	Remarks
1. Alum Rock	687.0		2	19. Hamann	10.5	45	
2. Arroyo	9.61	85		20. Hamline	.5	0	1, 3, 5
3. Biebrach	3.93	78		21. Hathaway	10.5	61	
4. Backesto	10.47	190		22. Kelly	155.968	440	
5. Butcher	10.0	32		23. Lone Hill	7.87		3
6. Cadwalder	.16	0	1, 5	*24. Los Alamitos	30.0		6, 4, 5
7. Calabazas	21.26	87		25. Moore	8.4		3
*8. Camp San Jose	22.0		6, 5	26. Mt. Pleasant	5.4		3
9. Capitol	7.39	100		27. Municipal Stadium	21.23		3, 5
10. Casa View	11.85	84		28. Noble	10.0		3, 4
11. Center Plaza	2.2	0	5	29. Ocala	10.0		5, 3, 4
12. Calitor	4.416		3, 6	30. Overfelt	32.0		3
13. Columbus	9.5	76		31. Palm Haven	.5	0	1, 5
14. Doerr	11.6	61	4	32. Peach Tree Lane	.2	0	1, 5
15. East Square	2.2	5		33. Pitner	9.9		5, 4
16. El Camino	.11	0	1, 5	34. Prusch	86.5		5, 4
17. Fernish	5.98		5, 3	**35. Raisch-Tuers	13.28		5, 3, 4
18. Great Oaks	10.0		5, 3, 6	36. River Glen	8.9	88	

* These parks are by use permit--Camp San Jose (Lake Tahoe) from the United States Department of Forestry; Los Alamitos from the Santa Clara Valley Water Conservation District--for use by the City of San Jose.

** Purchased 9/61 as part of Municipal Water System.

City of San Jose Parks	Gross Acres	Usable Total Area 1000 sq ft	Remarks
37. Rose Garden	11.02	38	
38. Ryland	3.5	5	
39. Santana	5.4	67	
40. Saratoga Creek	7.664	5	
41. Solari	8.5		3
42. St. James	7.99	0	
43. Starbird	11.0	47	
44. Watson	42.76	254	
45. Welch	11.3	58	
46. Wilcox	2.5	0	
47. William St.	42.256	220	
48. Willow St.	16.7	74	
Golf Courses			
49. Cambrian Park	122.5	3780	
50. Alma	27.0	240	
51. El Rancho Verde	55.6	1800	
52. Hillview, Public	11.8	400	
53. Pleasant Hills Cypress Green			3

Code of Remarks

1. The park is too small. Its gross area is less than or equal to 0.5 acre; i.e. its total usable area is nil.

2. The park is too big. Its usable area can accommodate a substantial fraction of the San Jose population.

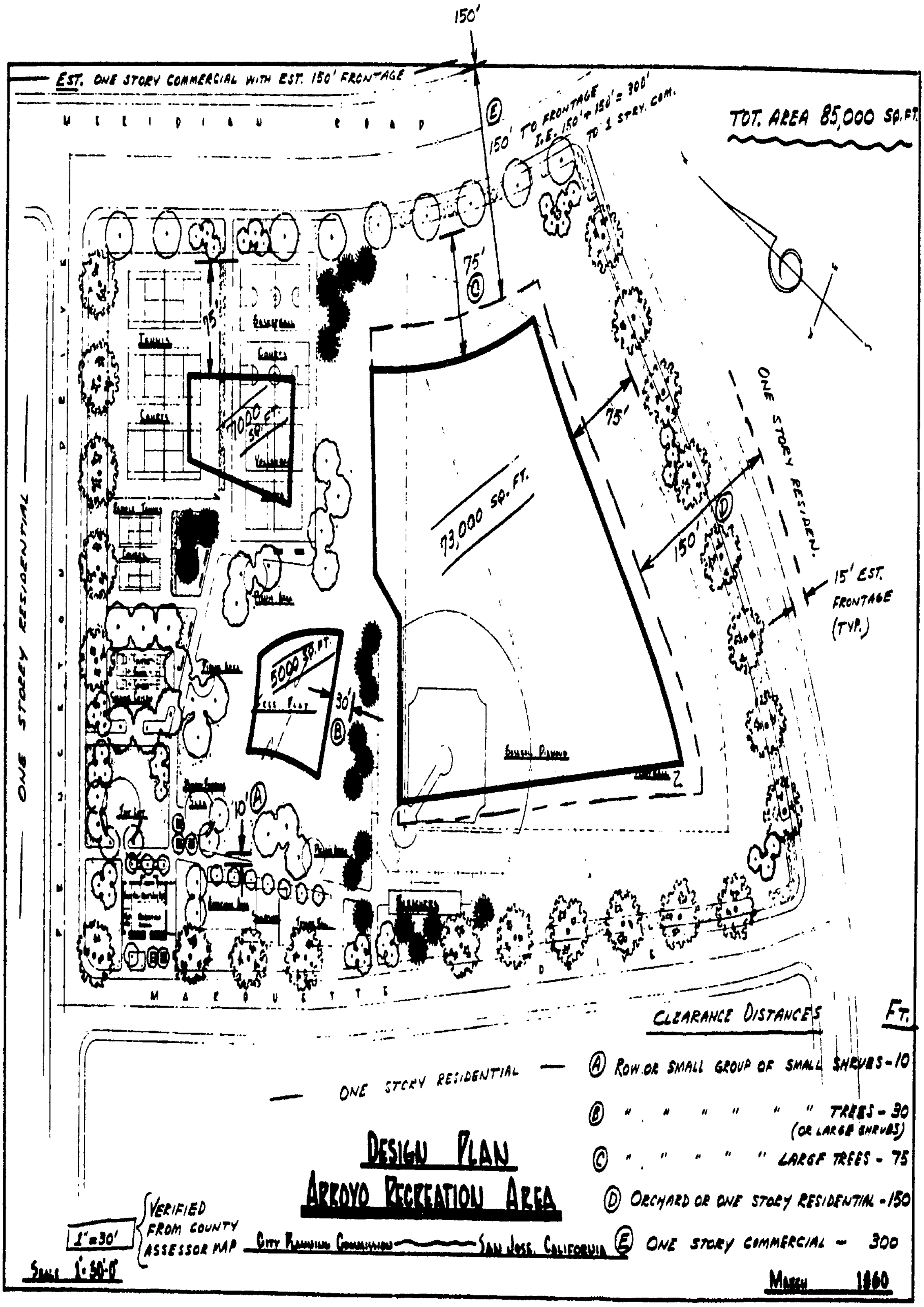
3. The neighboring area is not much populated; considering the surrounding existing open areas including farms and fields, the park is too big.

4. A proposed park. Open area exists but the park is not yet developed.

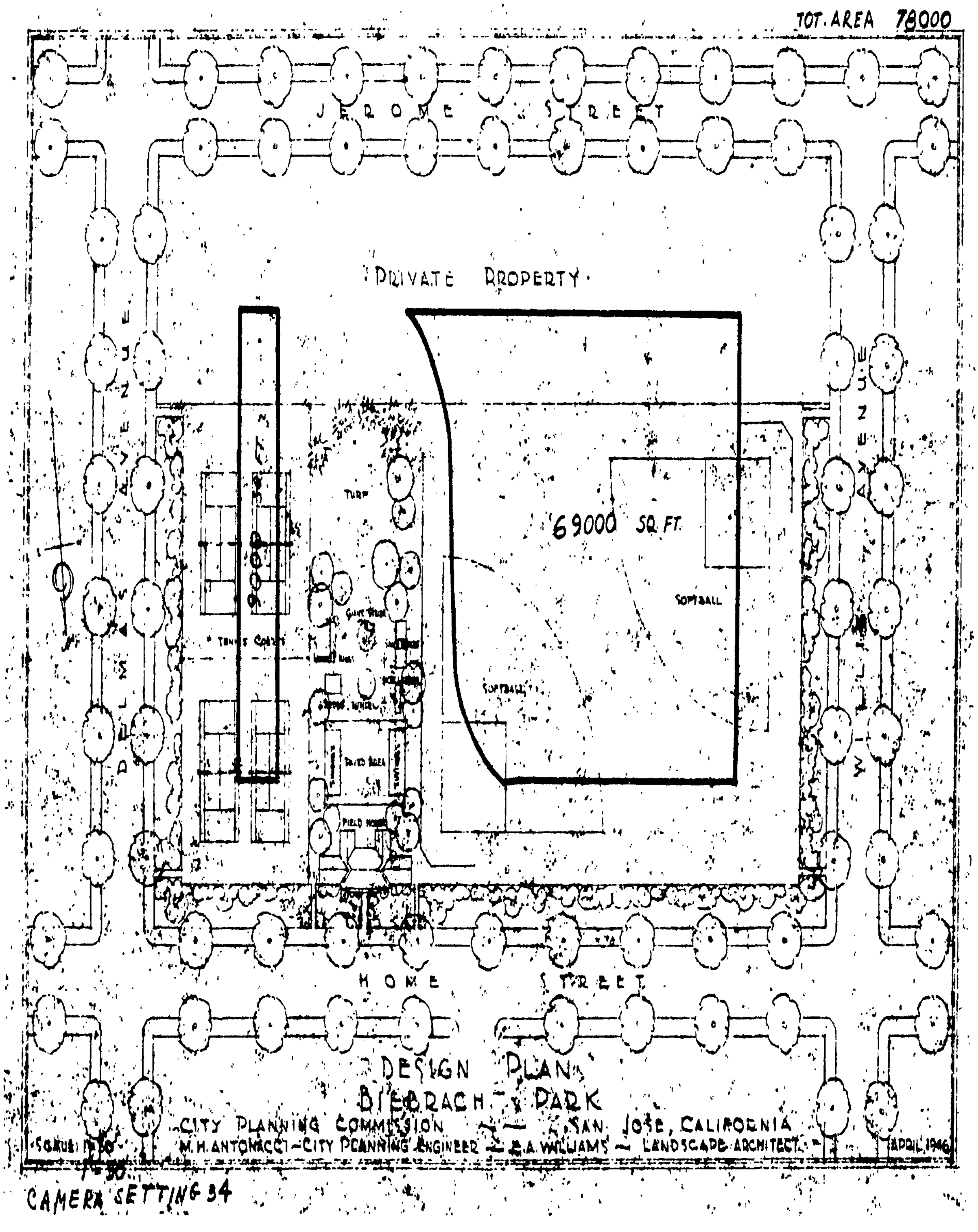
5. The detailed plan is not available.

6. The park is located beyond the area of our interest.

2. ARROYO

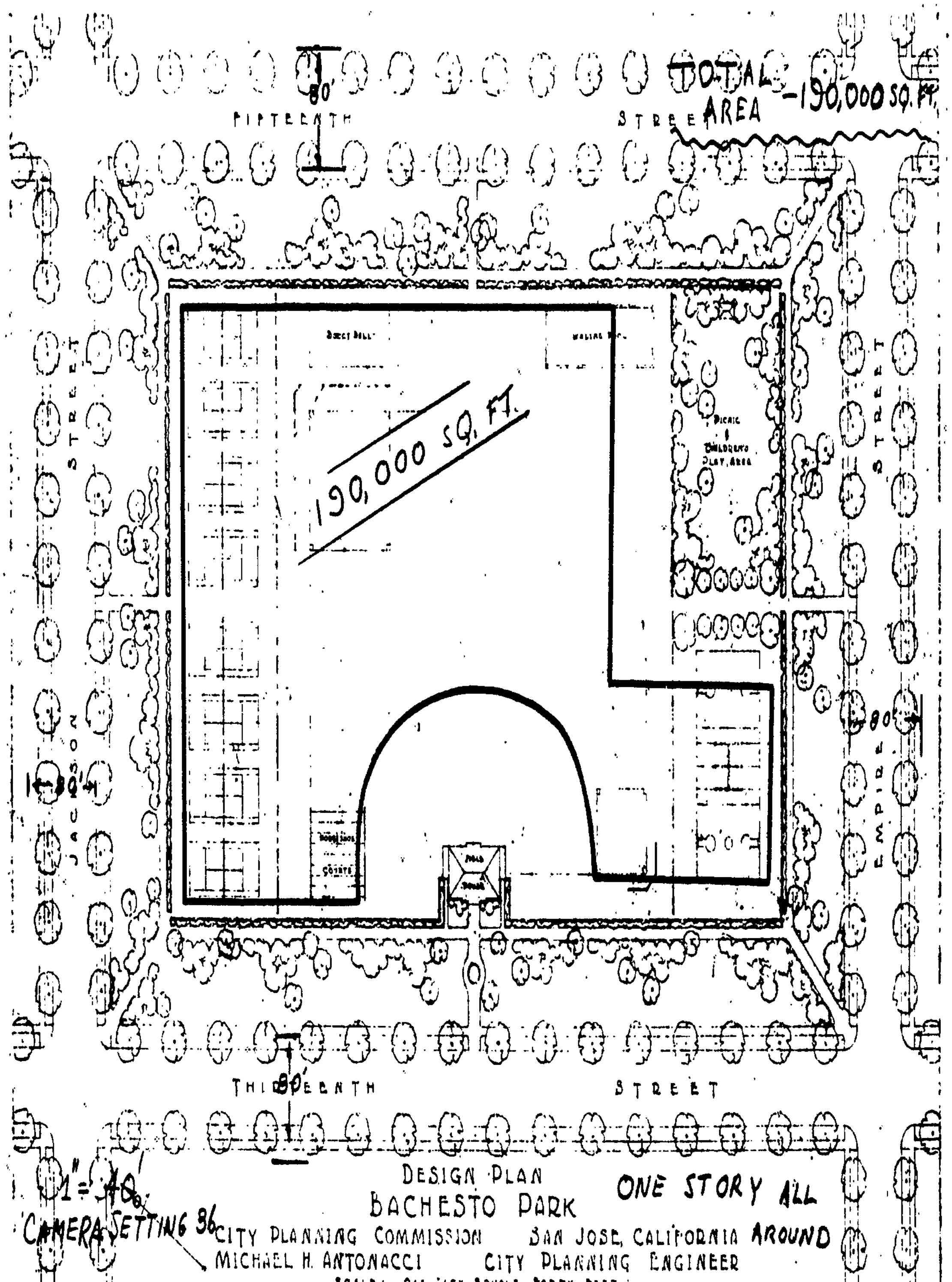

150'
EST. ONE STORY COMMERCIAL WITH EST. 150' FRONTAGE
TOT. AREA 85,000 SQ.FT.
150' TO FRONTAGE I.E. 150'+150' = 300' TO 1 STRY. COM.
75'
7000 SQ. FT.
73,000 SQ. FT.
5000 SQ. FT.
30'
10'
150'
ONE STORY RESIDEN.
15' EST. FRONTAGE (TYP.)
ONE STOREY RESIDENTIAL
ONE STORY RESIDENTIAL
CLEARANCE DISTANCES FT.
(A) ROW OR SMALL GROUP OF SMALL SHRUBS - 10
(B) " " " " " " TREES - 30 (OR LARGE SHRUBS)
(C) " " " " " LARGE TREES - 75
(D) ORCHARD OR ONE STORY RESIDENTIAL - 150
(E) ONE STORY COMMERCIAL - 300
DESIGN PLAN
ARROYO RECREATION AREA
1" = 30'
VERIFIED FROM COUNTY ASSESSOR MAP
CITY PLANNING COMMISSION — SAN JOSE, CALIFORNIA
SCALE 1" = 30'-0"
MARCH 1960

3. BIEBRACH

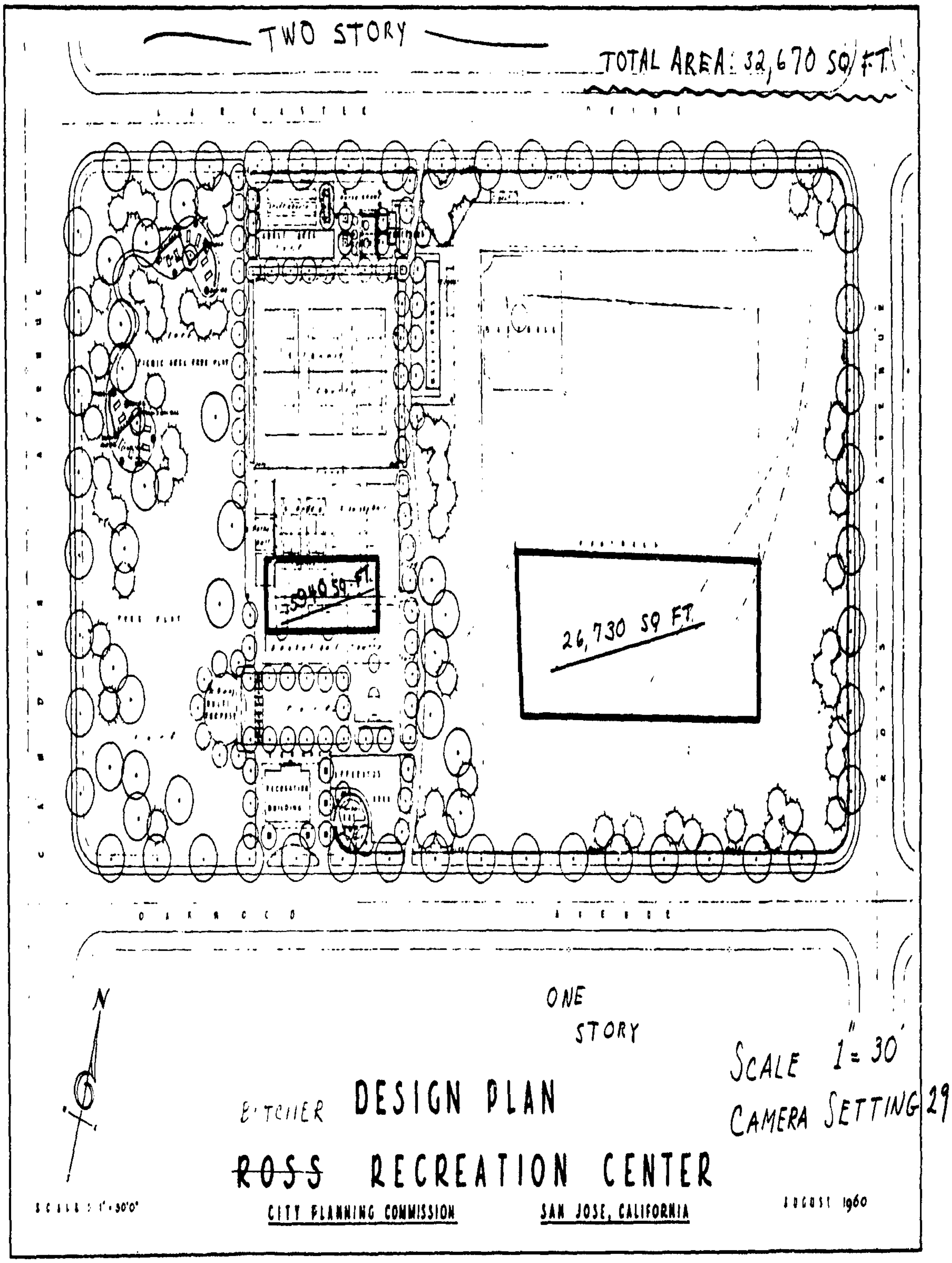


TOT. AREA 78000
JEROME STREET
PRIVATE PROPERTY
9000 SQ FT
69000 SQ. FT.
TURF
TENNIS COURTS
SOFTBALL
SOFTBALL
PAVED AREA
FIELD HOUSE
HOME STREET
DESIGN PLAN
BIEBRACH PARK
CITY PLANNING COMMISSION — SAN JOSE, CALIFORNIA
M. H. ANTONACCI — CITY PLANNING ENGINEER — A. WILLIAMS — LANDSCAPE ARCHITECT
APRIL 1946
CAMERA SETTING 34

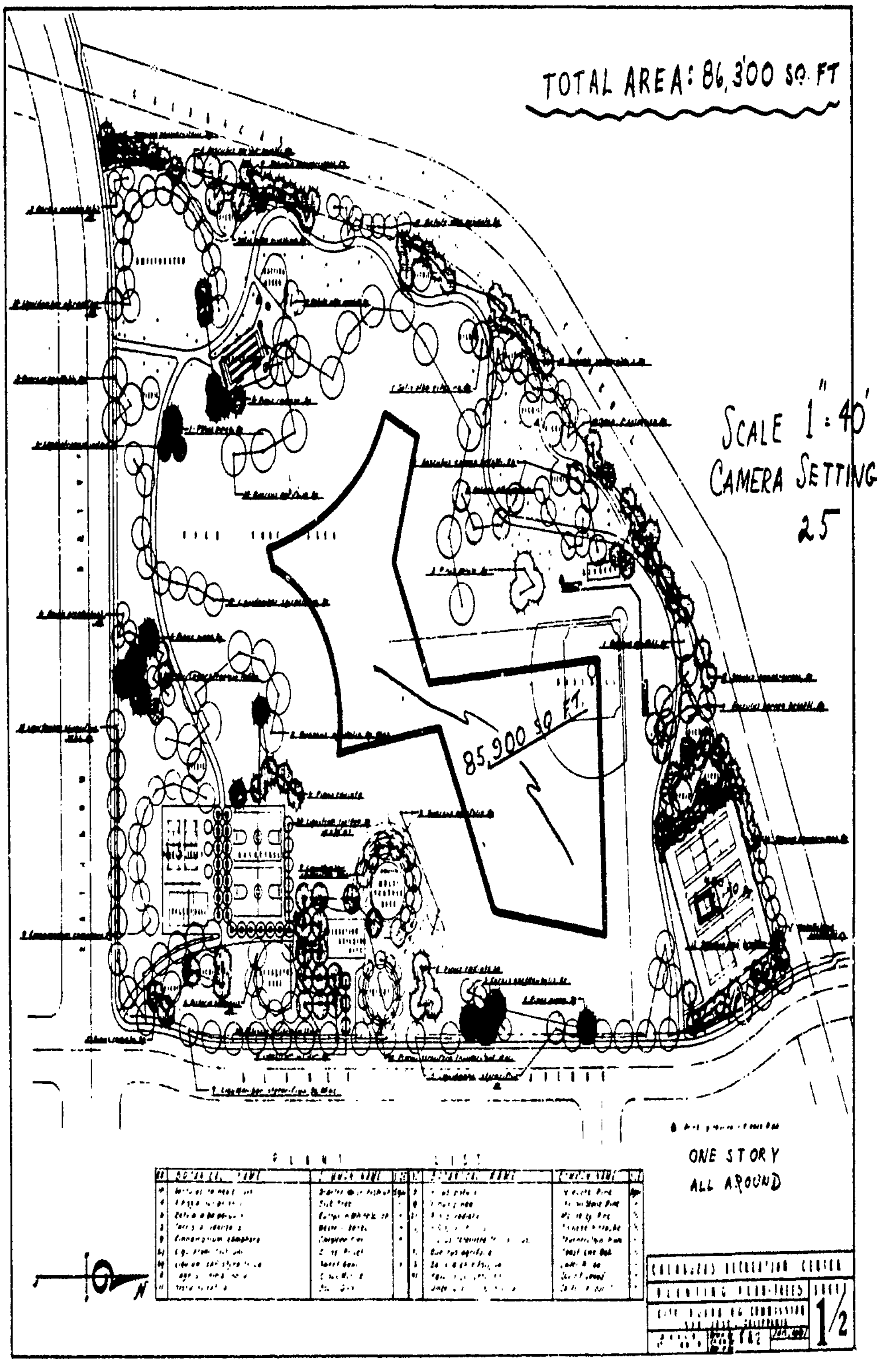
4. BACKESTO


FIFTEENTH STREET
TOTAL AREA -190,000 SQ.FT.
80'
190,000 SQ. FT.
JACKSON STREET
EMPIRE STREET
80'
THIRTEENTH STREET
80'
80'
1" = 40'
CAMERA SETTING 36
ONE STORY ALL AROUND
DESIGN PLAN
BACHESTO PARK
CITY PLANNING COMMISSION SAN JOSE, CALIFORNIA
MICHAEL H. ANTONACCI CITY PLANNING ENGINEER
SCALE: ONE INCH EQUALS FORTY FEET

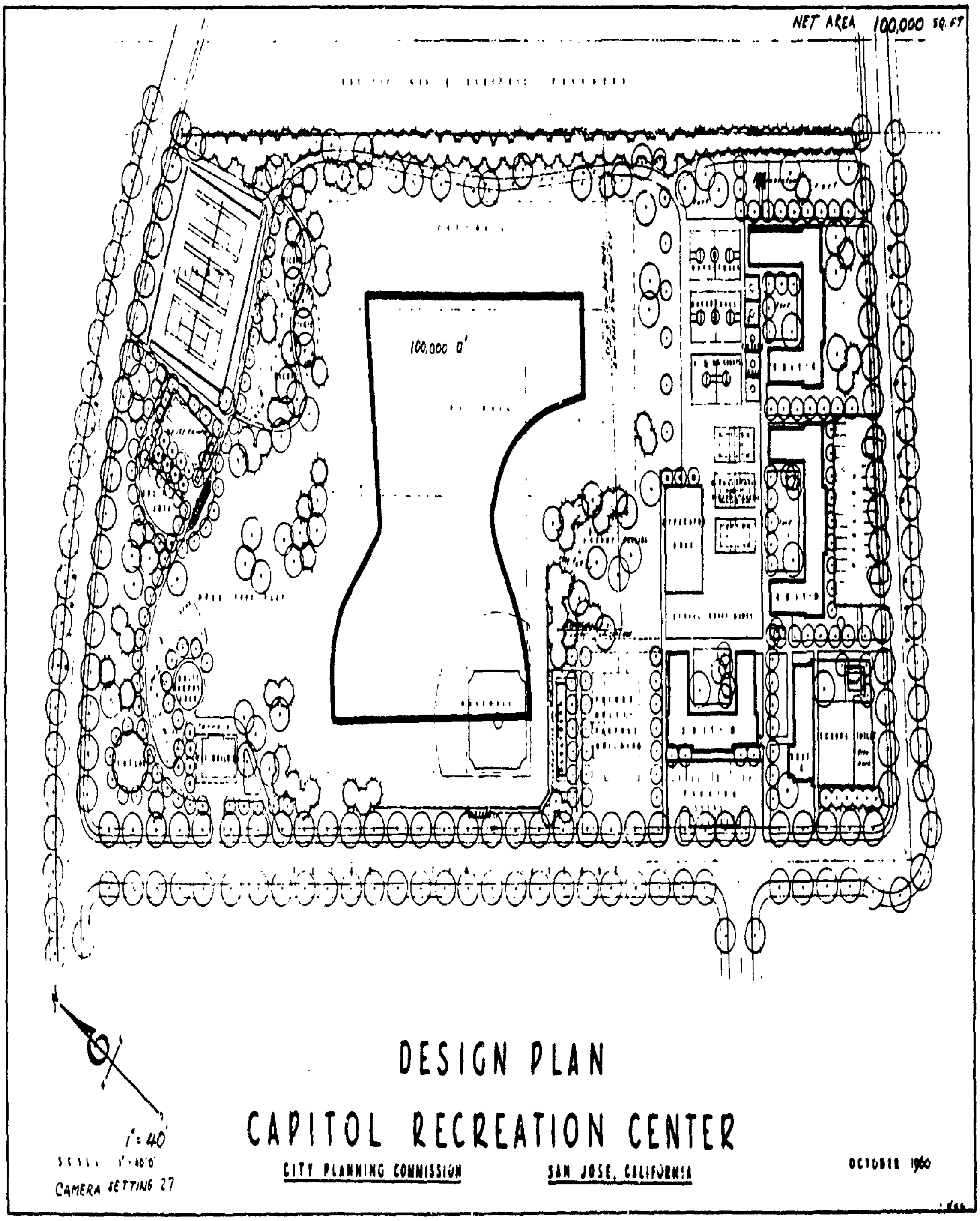
5. BUTCHER


TWO STORY
TOTAL AREA: 32,670 SQ FT
5,940 SQ FT
26,730 SQ FT
ONE STORY
N
SCALE 1" = 30'
CAMERA SETTING 29
BUTCHER DESIGN PLAN
ROSS RECREATION CENTER
CITY PLANNING COMMISSION
SAN JOSE, CALIFORNIA
AUGUST 1960

7. CALABAZAS

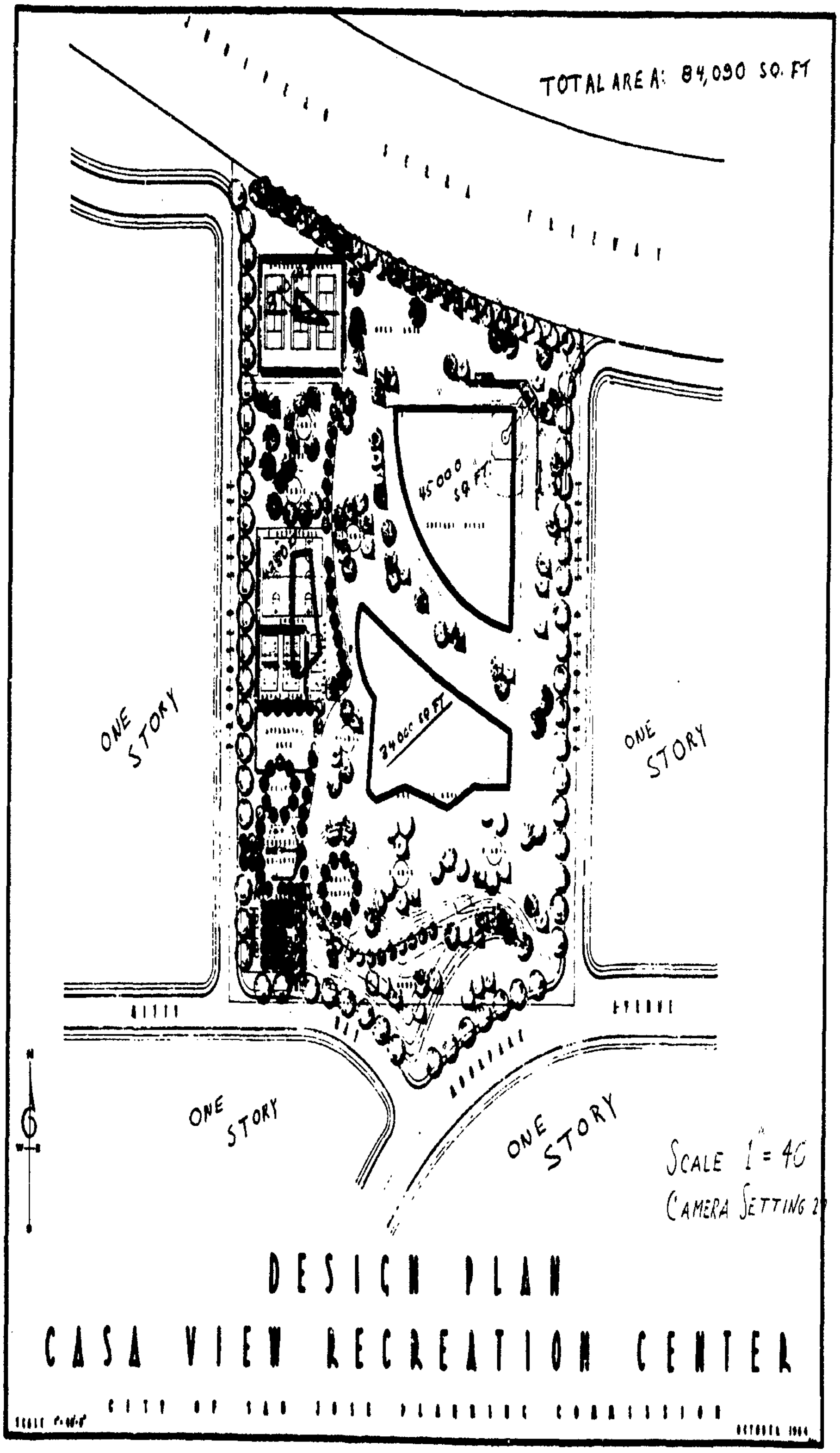

TOTAL AREA: 86,300 SQ. FT
SCALE 1" : 40'
CAMERA SETTING
25
85,900 SQ. FT.
ONE STORY
ALL AROUND
1/2

9. CAPITOL

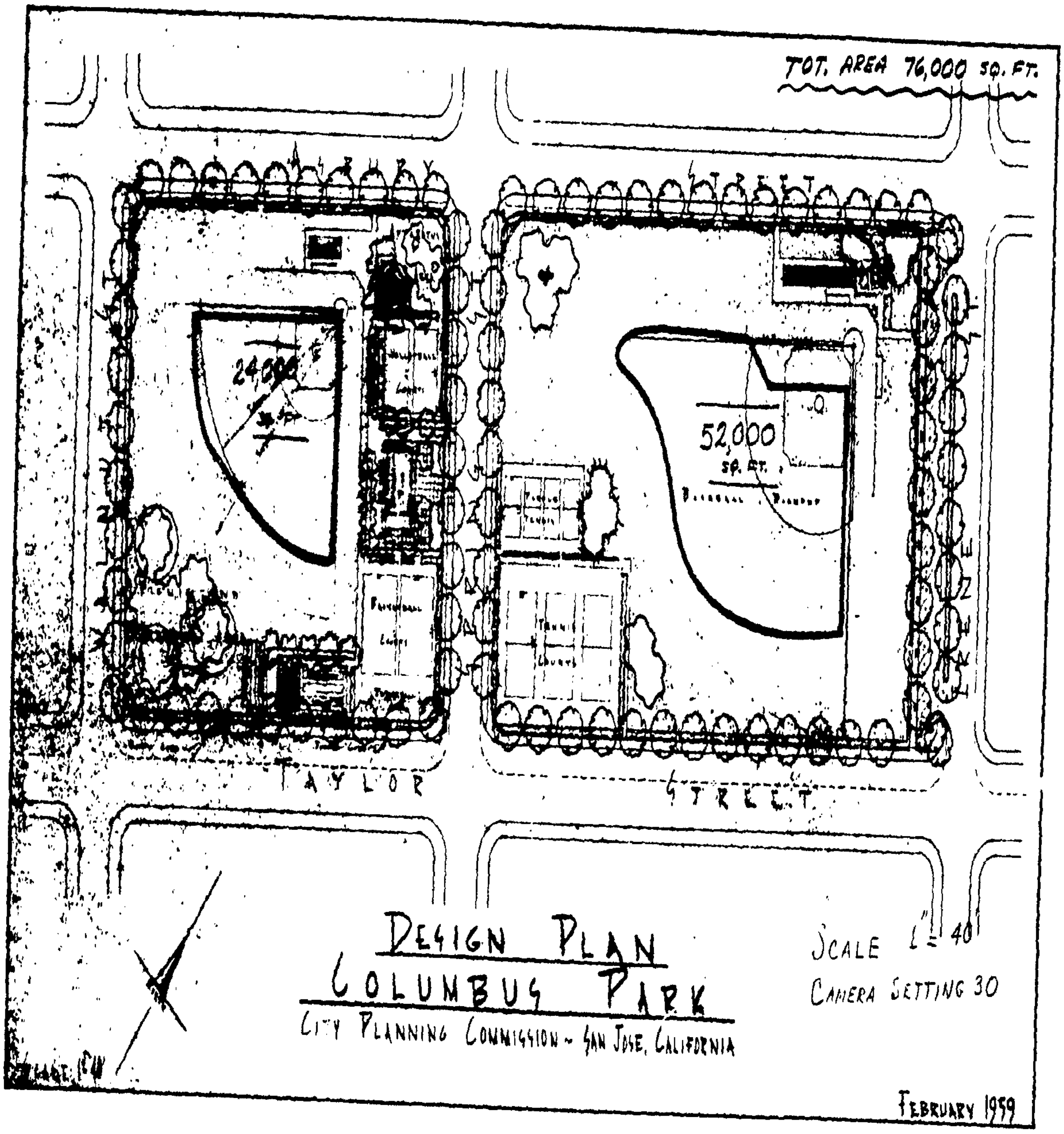


NET AREA 100,000 SQ. FT
100,000 □'
DESIGN PLAN
CAPITOL RECREATION CENTER
1" = 40'
CAMERA SETTING 27
CITY PLANNING COMMISSION
SAN JOSE, CALIFORNIA
OCTOBER 1960

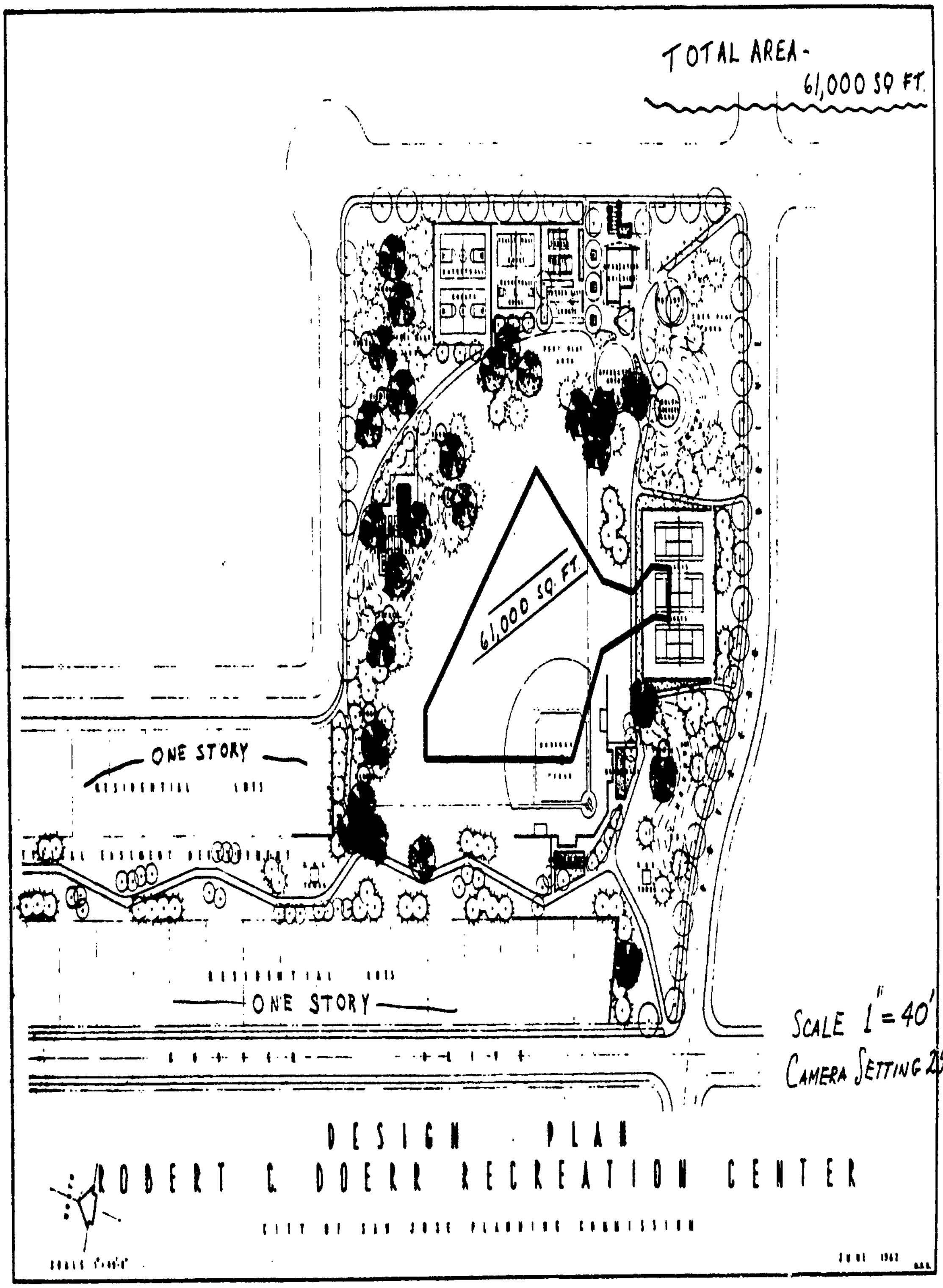
10. CASA VIEW


TOTAL AREA: 84,090 SQ. FT
45000 SQ. FT.
34000 SQ FT
ONE STORY
ONE STORY
ONE STORY
ONE STORY
SCALE 1" = 40
CAMERA SETTING 2
DESIGN PLAN
CASA VIEW RECREATION CENTER

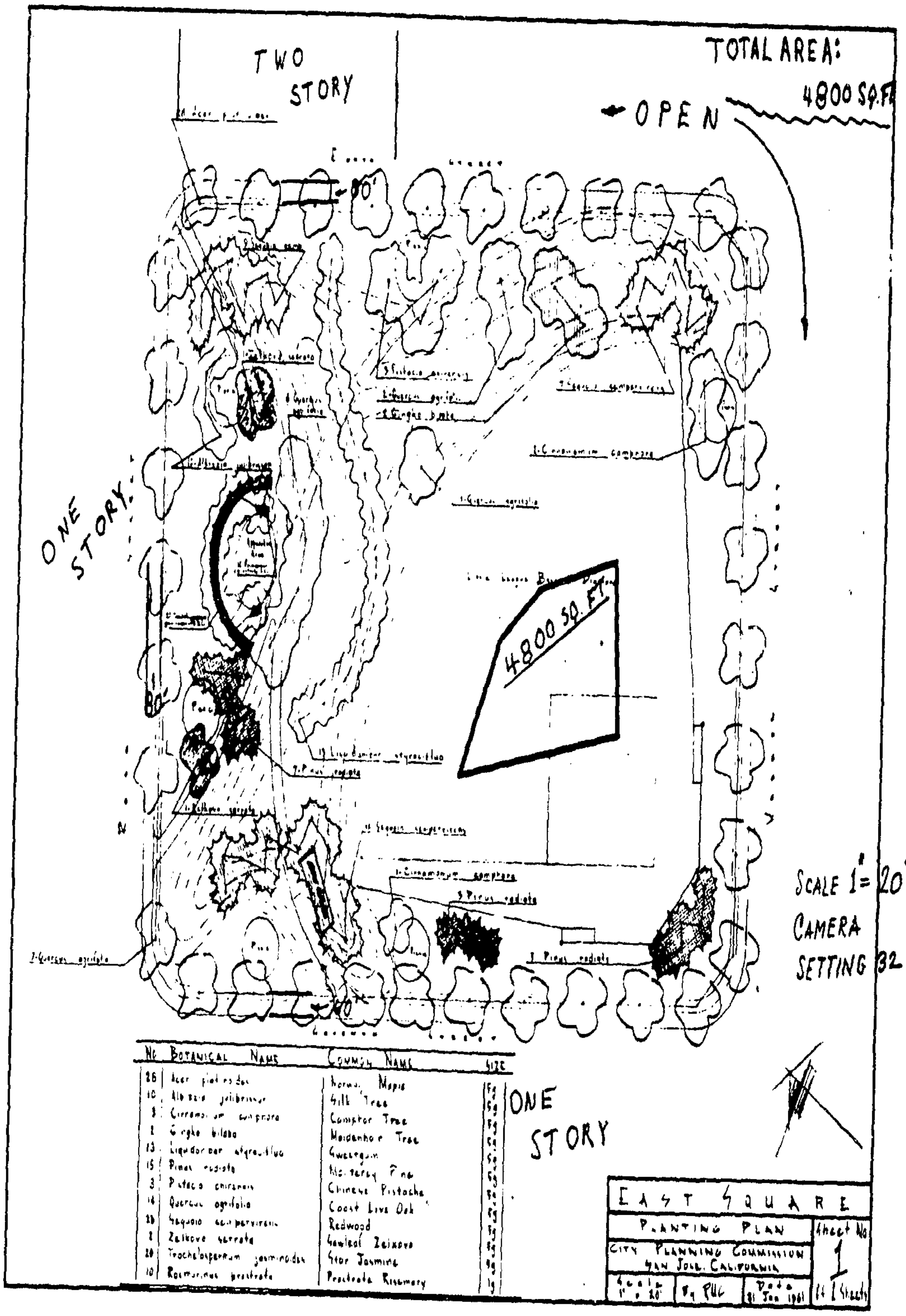
13. COLUMBUS



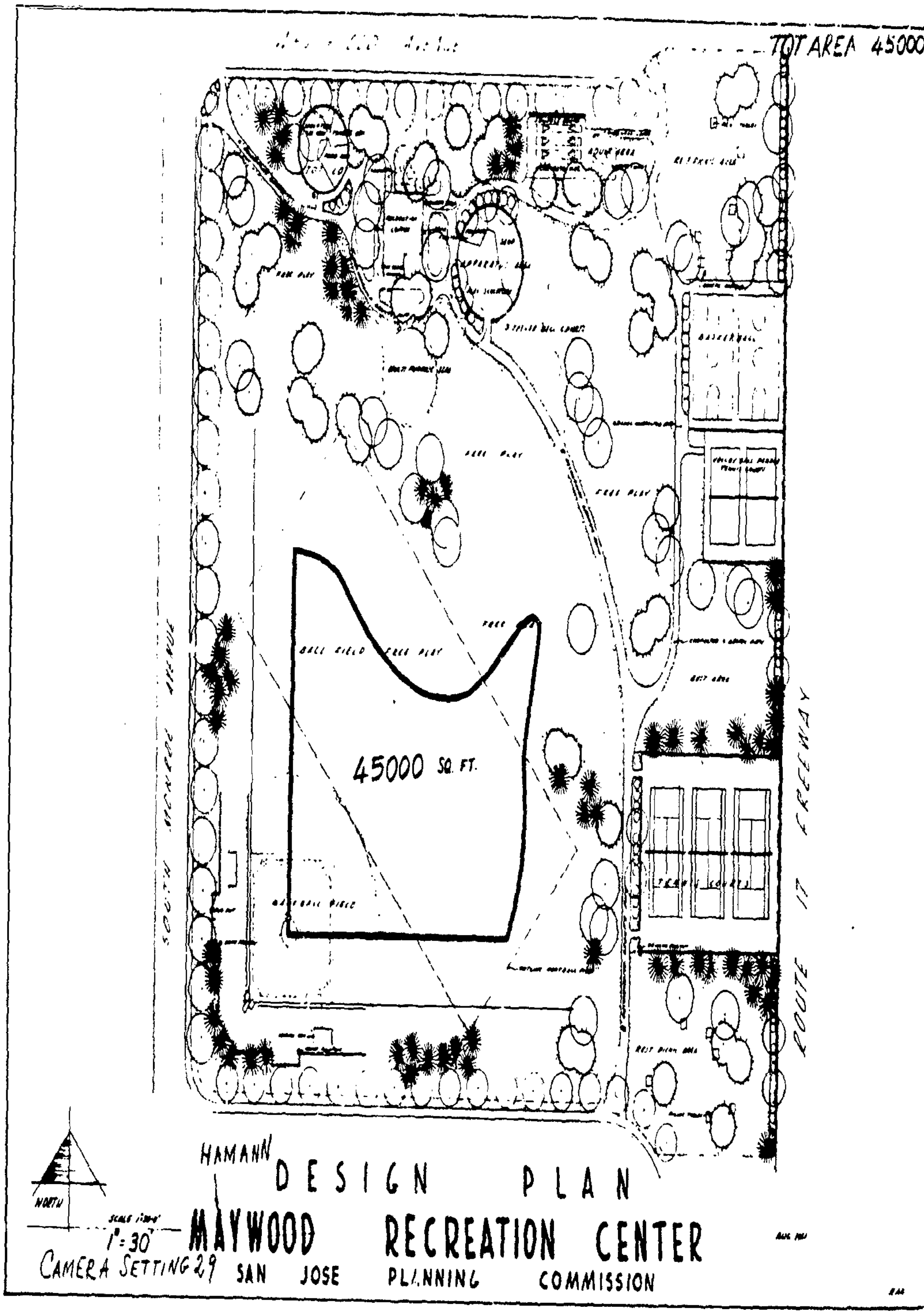
TOT. AREA 76,000 SQ. FT.
24,000 SQ. FT.
52,000 SQ. FT.
TAYLOR STREET
DESIGN PLAN
COLUMBUS PARK
CITY PLANNING COMMISSION ~ SAN JOSE, CALIFORNIA
SCALE 1" = 40'
CAMERA SETTING 30
FEBRUARY 1959


TOTAL AREA - 61,000 SQ FT
61,000 SQ. FT.
ONE STORY
RESIDENTIAL LOTS
RESIDENTIAL LOTS
ONE STORY
SCALE 1" = 40'
CAMERA SETTING 25
DESIGN PLAN
ROBERT C. DOERR RECREATION CENTER
CITY OF SAN JOSE PLANNING COMMISSION

15. EAST SQUARE

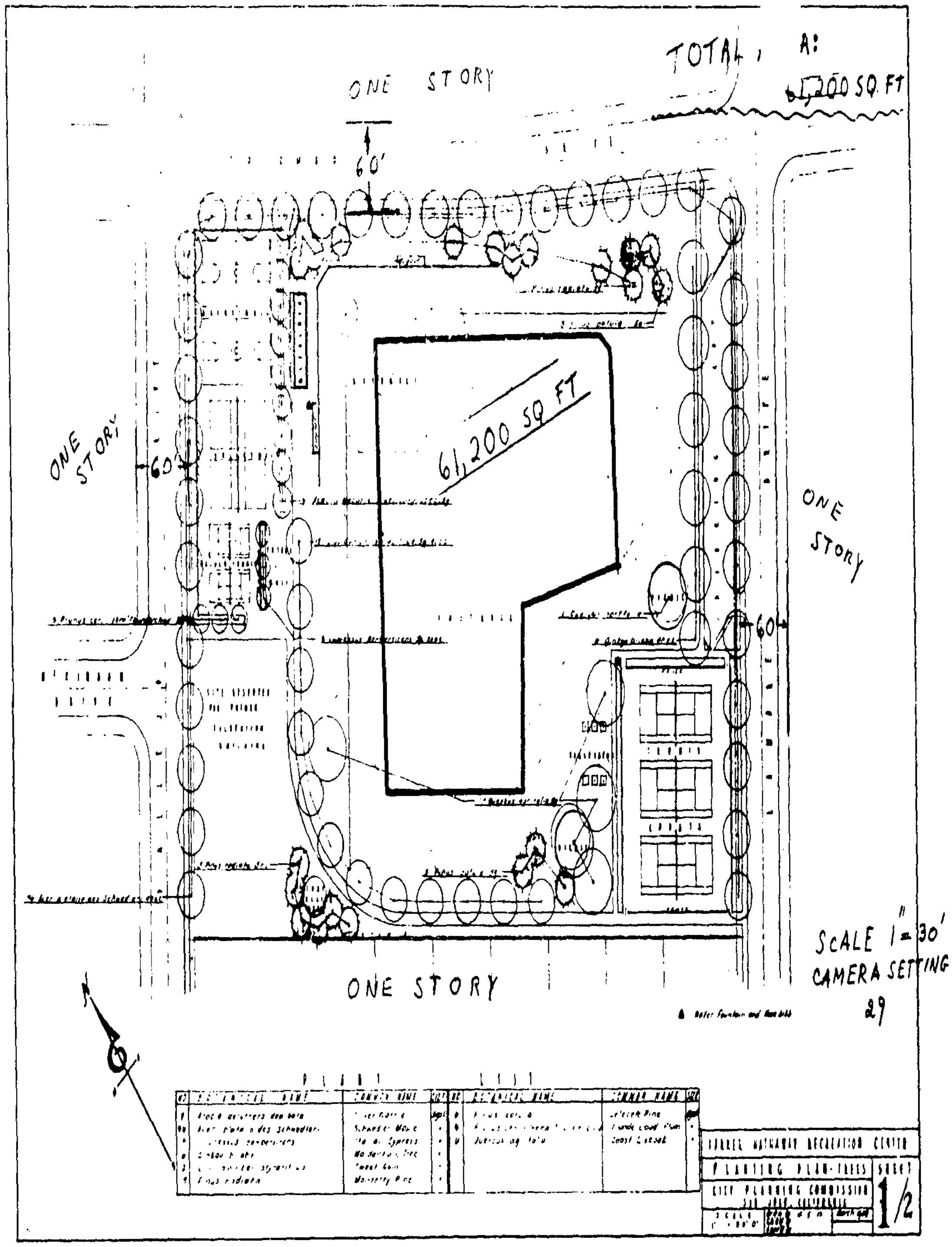


19. HAMANN



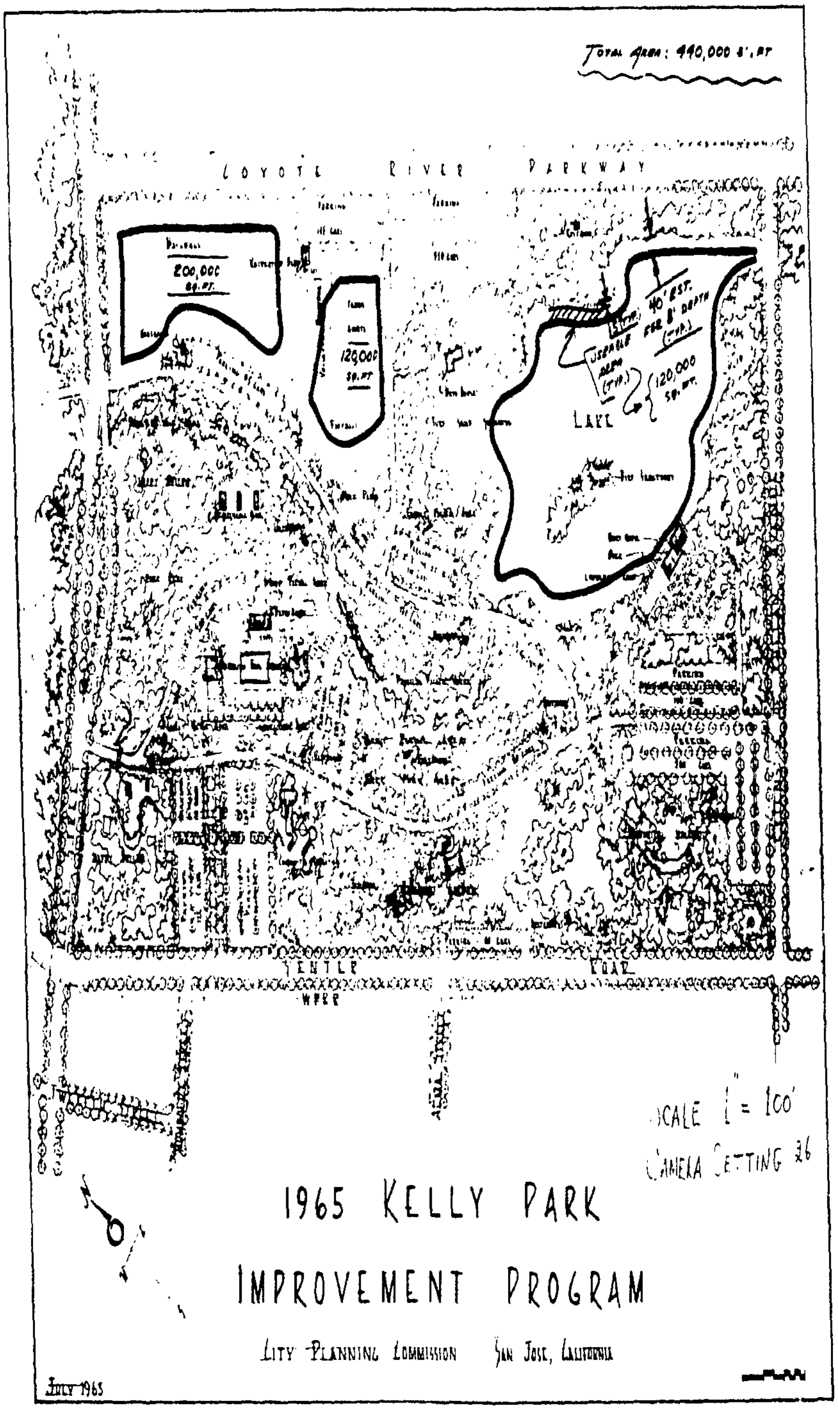
TOT AREA 45000 SQ. FT.
BASKETBALL
FREE PLAY
BALL FIELD
45000 SQ. FT.
TENNIS COURTS
SOUTH ... AVENUE
ROUTE 17 FREEWAY
NORTH
HAMANN
DESIGN PLAN
1"=30'
MAYWOOD RECREATION CENTER
CAMERA SETTING 29
SAN JOSE PLANNING COMMISSION

21. HATHAWAY

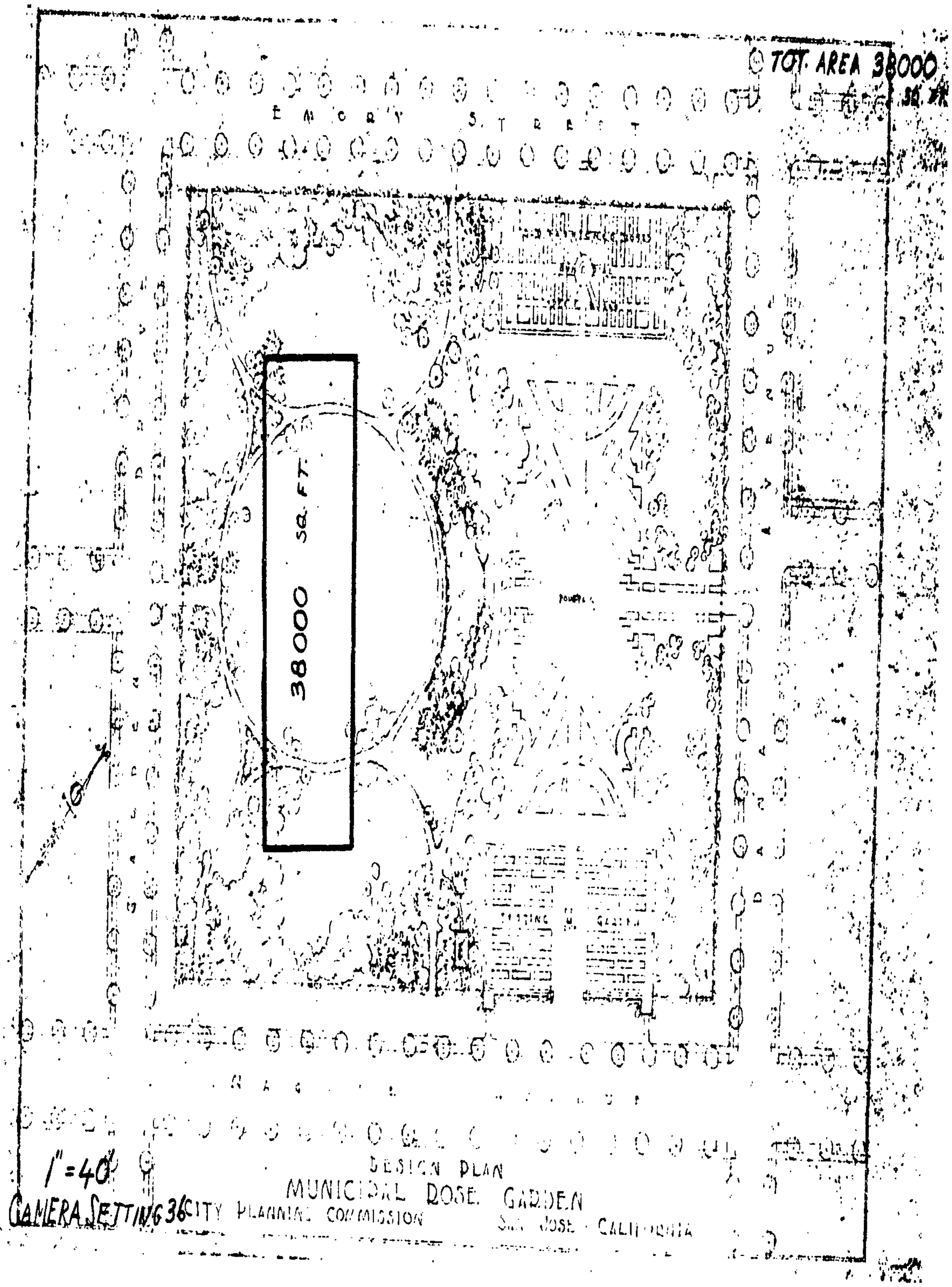


TOTAL, A:
61,200 SQ FT
ONE STORY
60'
ONE STORY
60'
61,200 SQ FT
ONE STORY
60'
ONE STORY
SCALE 1"=30'
CAMERA SETTING
29

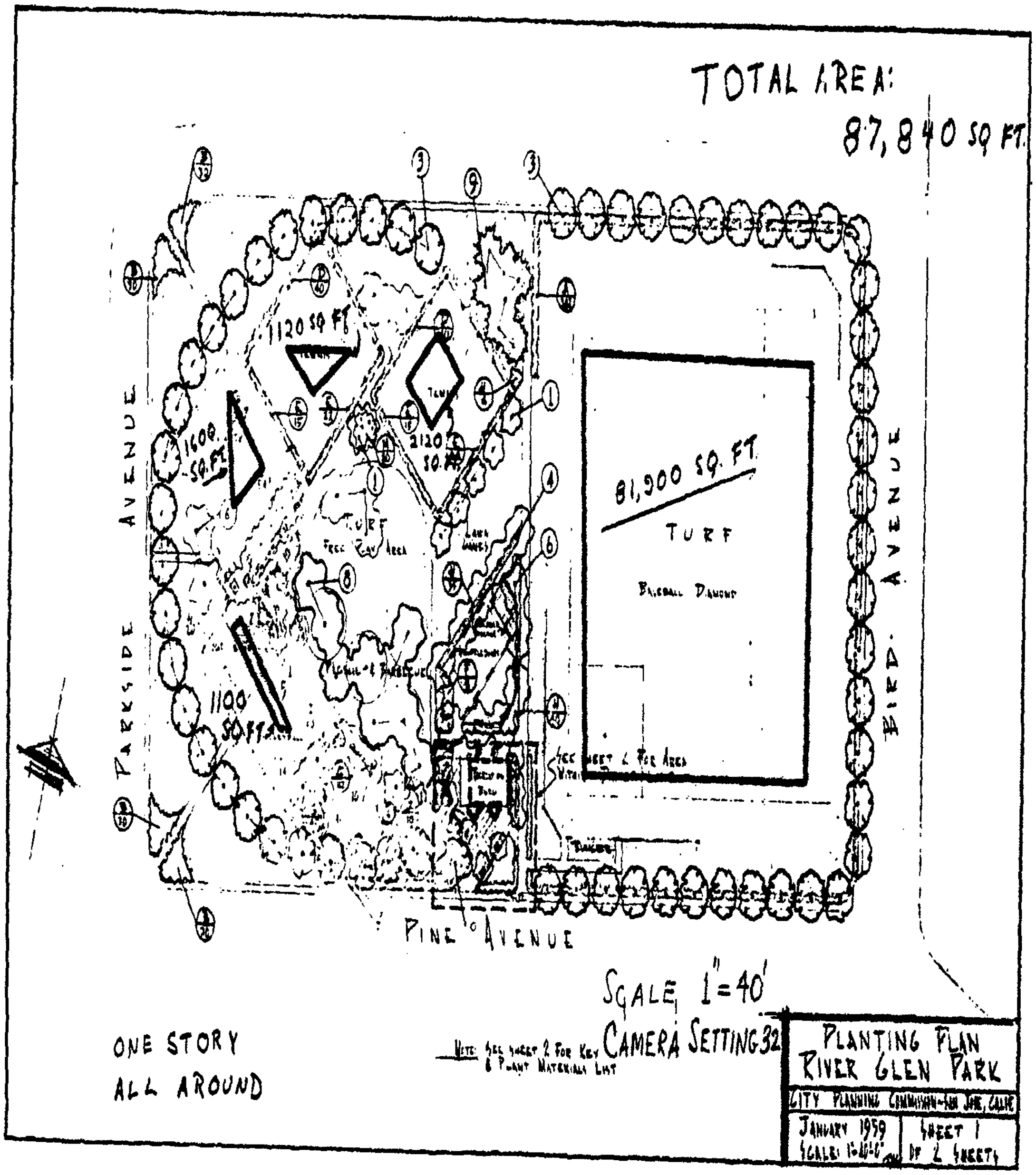
22. KELLY


TOTAL AREA: 440,000 SQ. FT
COYOTE RIVER PARKWAY
200,000 SQ. FT.
120,000 SQ. FT
120,000 SQ. FT.
LAKE
SCALE 1" = 100'
CAMERA SETTING 36
1965 KELLY PARK
IMPROVEMENT PROGRAM
CITY PLANNING COMMISSION SAN JOSE, CALIFORNIA
JULY 1965

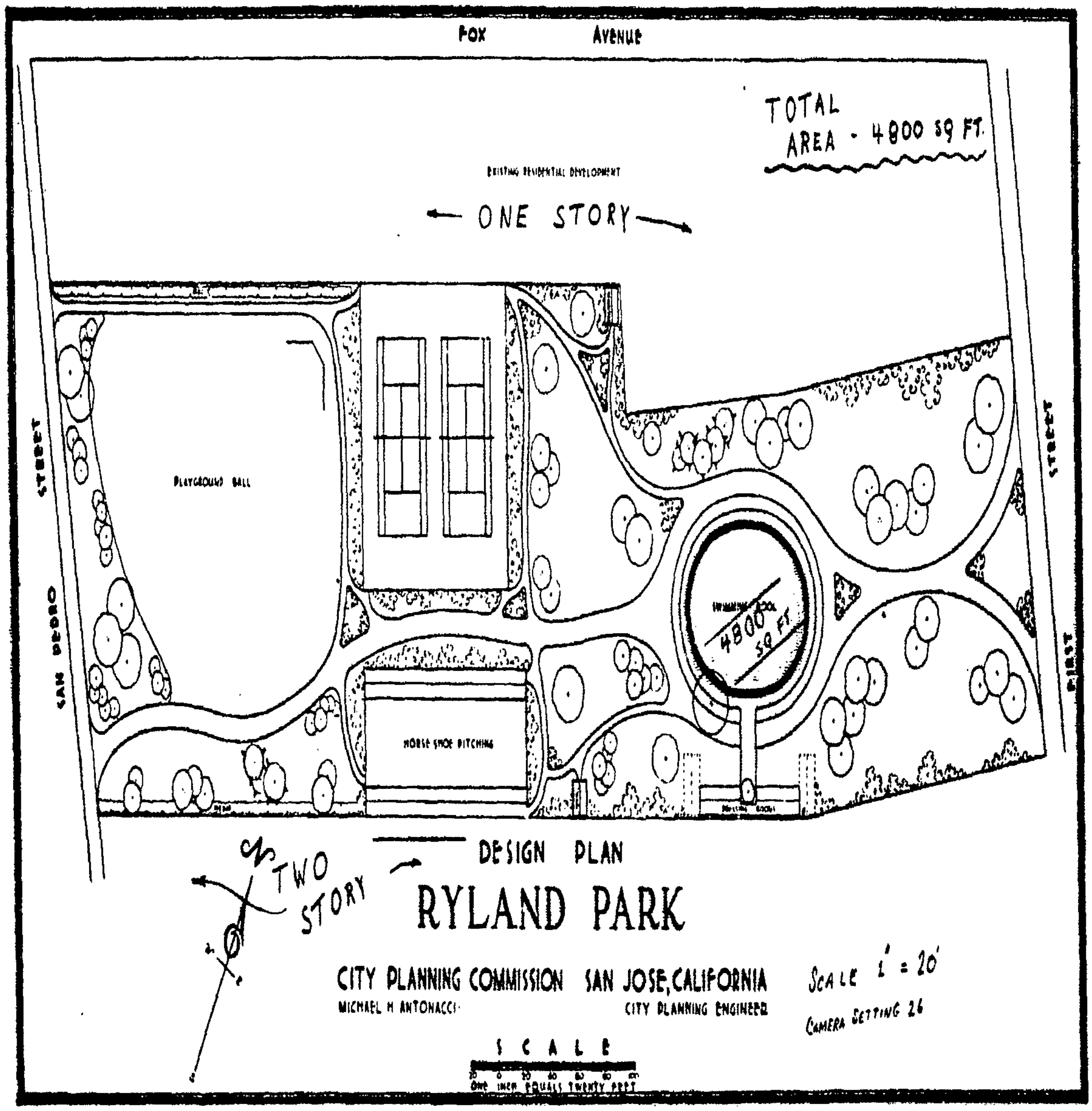
27. MUNICIPAL STADIUM



36. RIVER GLEN

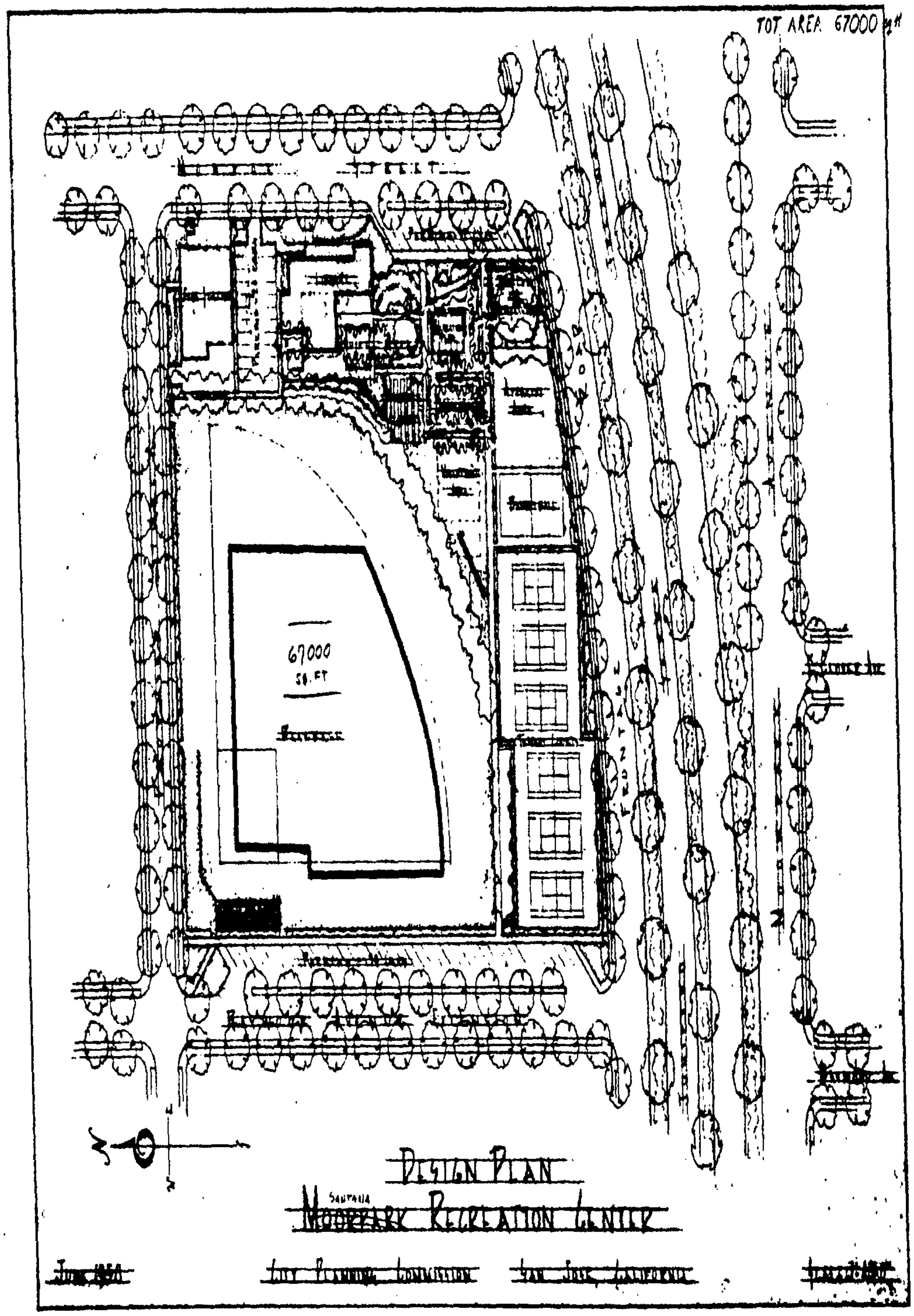


38. RYLAND



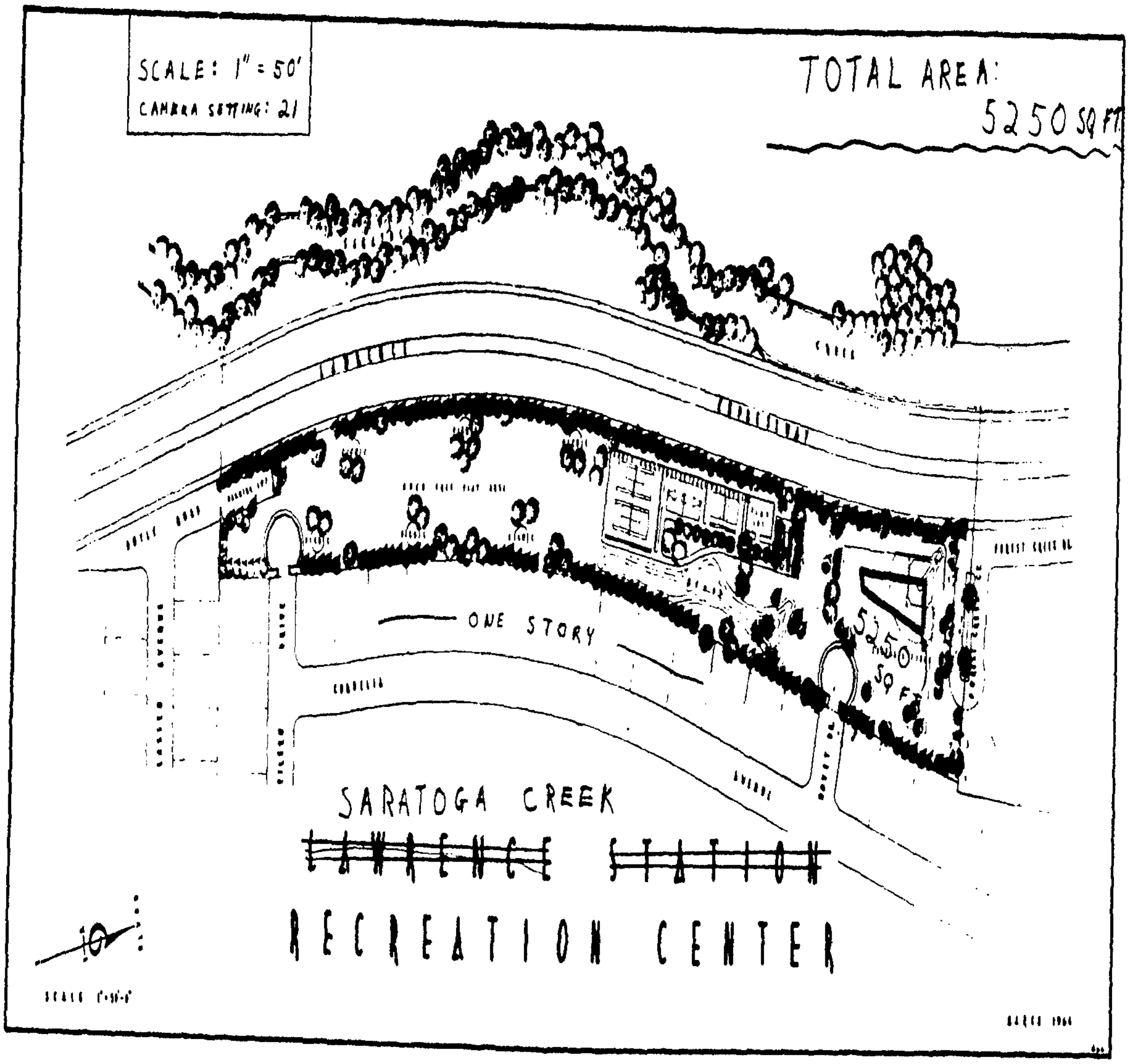
FOX AVENUE
TOTAL AREA - 4800 SQ FT.
EXISTING RESIDENTIAL DEVELOPMENT
ONE STORY
PLAYGROUND BALL
SWIMMING POOL
4800 SQ FT.
HORSE SHOE PITCHING
SAN PEDRO STREET
FIRST STREET
TWO STORY
DESIGN PLAN
RYLAND PARK
CITY PLANNING COMMISSION SAN JOSE, CALIFORNIA
MICHAEL H ANTONACCI CITY PLANNING ENGINEER
SCALE 1" = 20'
CAMERA SETTING 26
SCALE
ONE INCH EQUALS TWENTY FEET

39. SANTANA

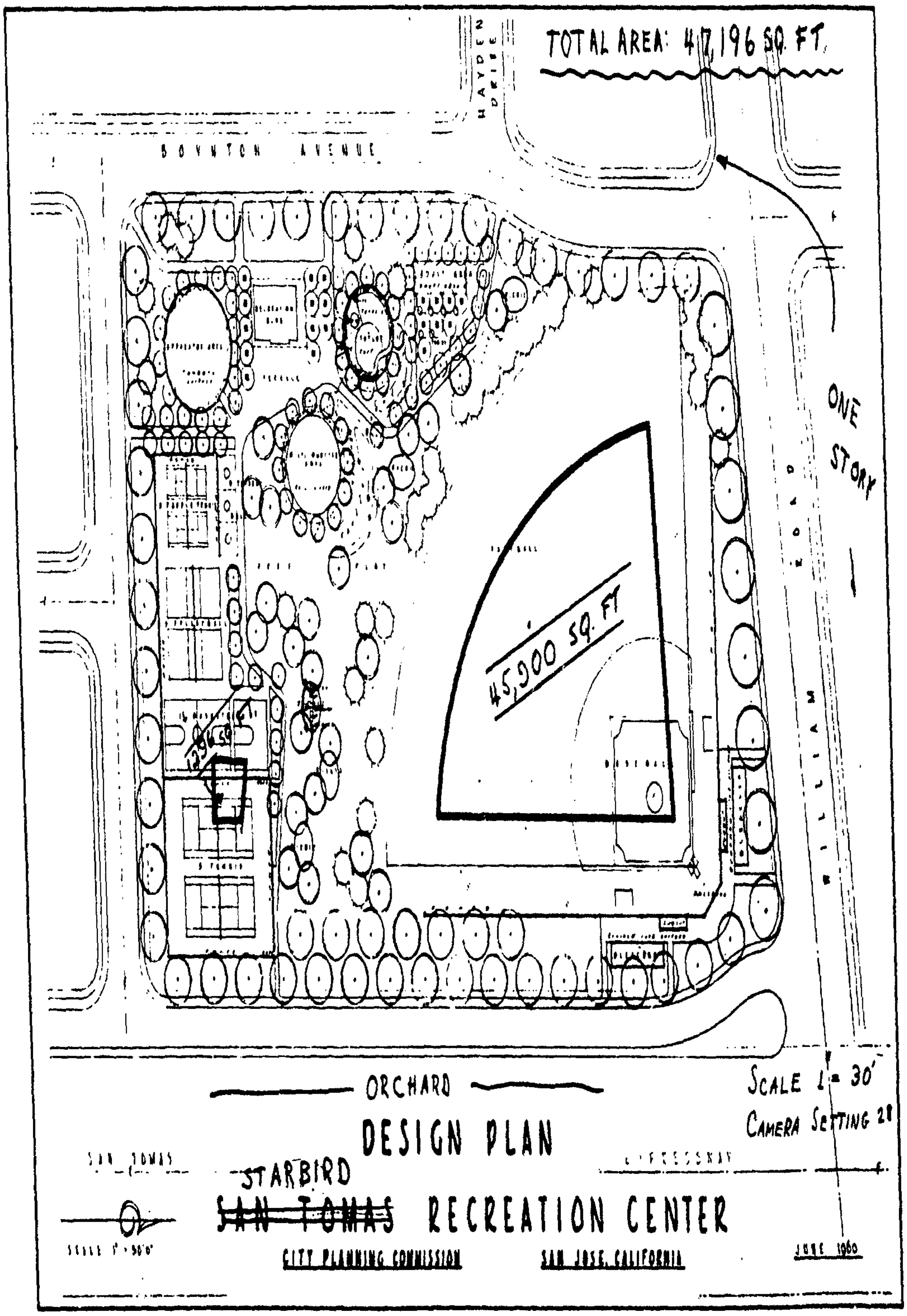


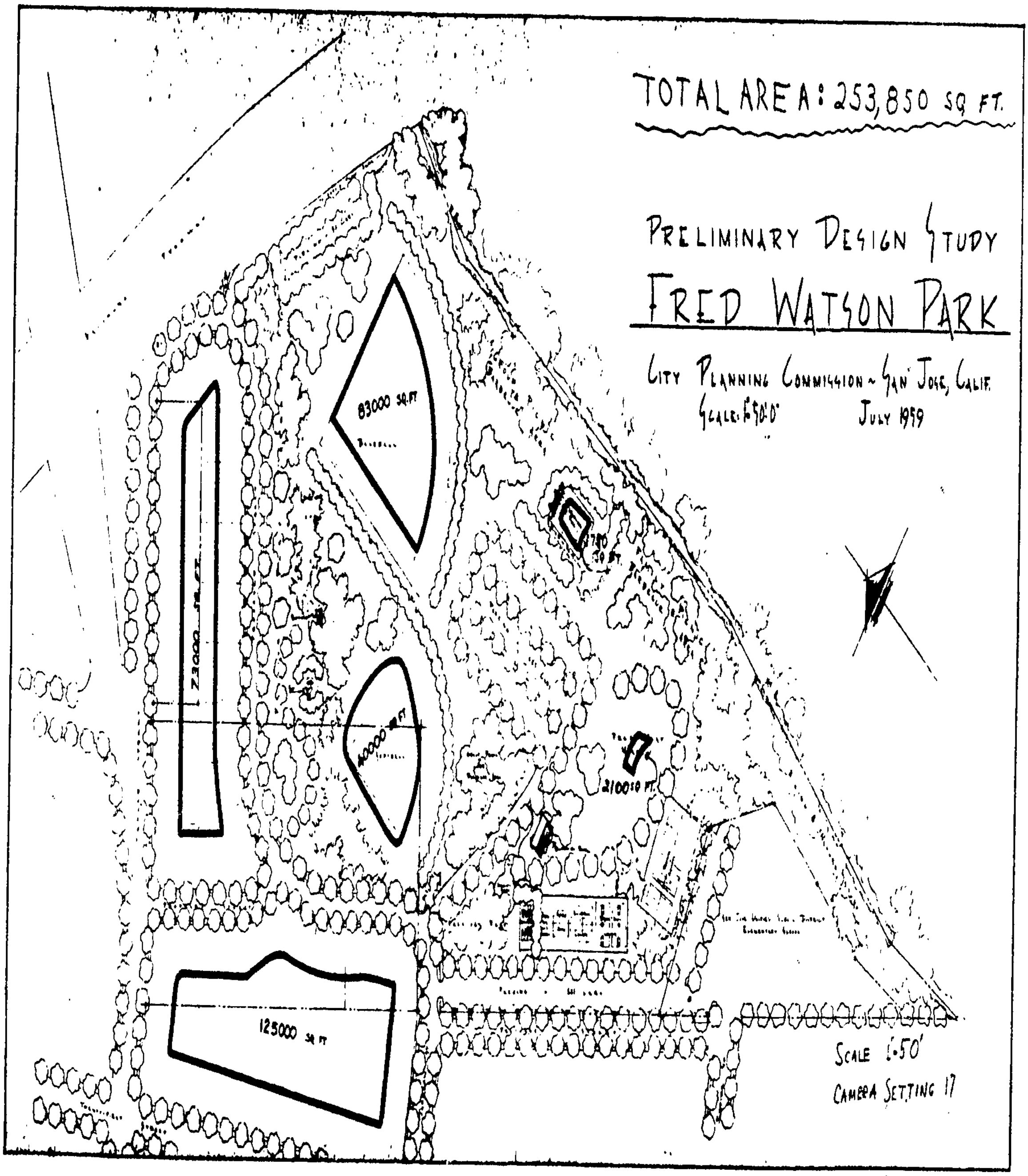
TOT. AREA 67000
67000 SQ. FT
DESIGN PLAN
SANTANA
MOORPARK RECREATION CENTER

40. SARATOGA CREEK

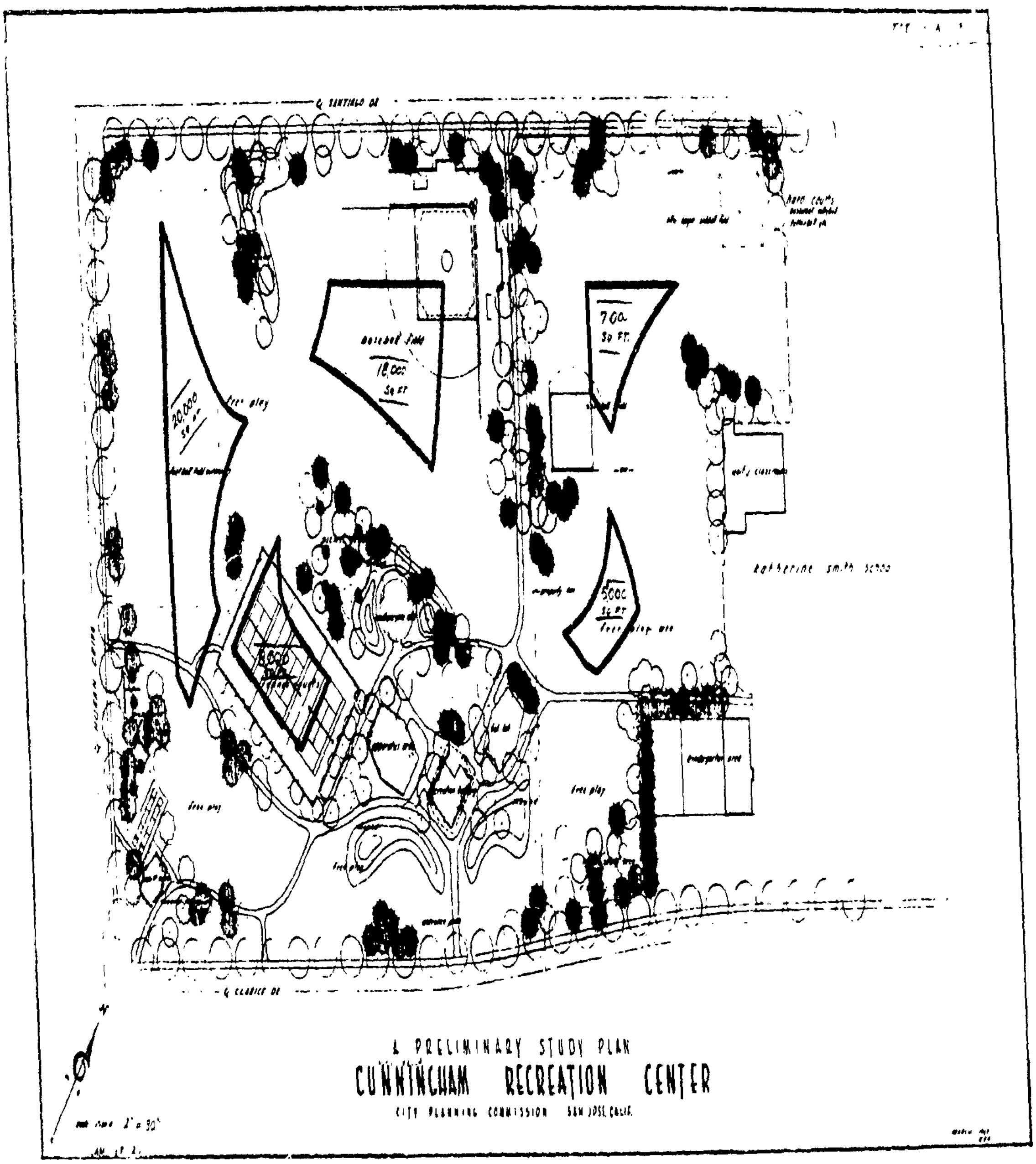


43. STARBIRD


TOTAL AREA: 47,196 SQ. FT.
BOYNTON AVENUE
HAYDEN DRIVE
ONE STORY
45,900 SQ. FT
WILLIAMS ROAD
ORCHARD
SCALE 1" = 30'
CAMERA SETTING 28
DESIGN PLAN
SAN TOMAS
FREEWAY
STARBIRD
~~SAN TOMAS~~ RECREATION CENTER
CITY PLANNING COMMISSION
SAN JOSE, CALIFORNIA
JUNE 1960

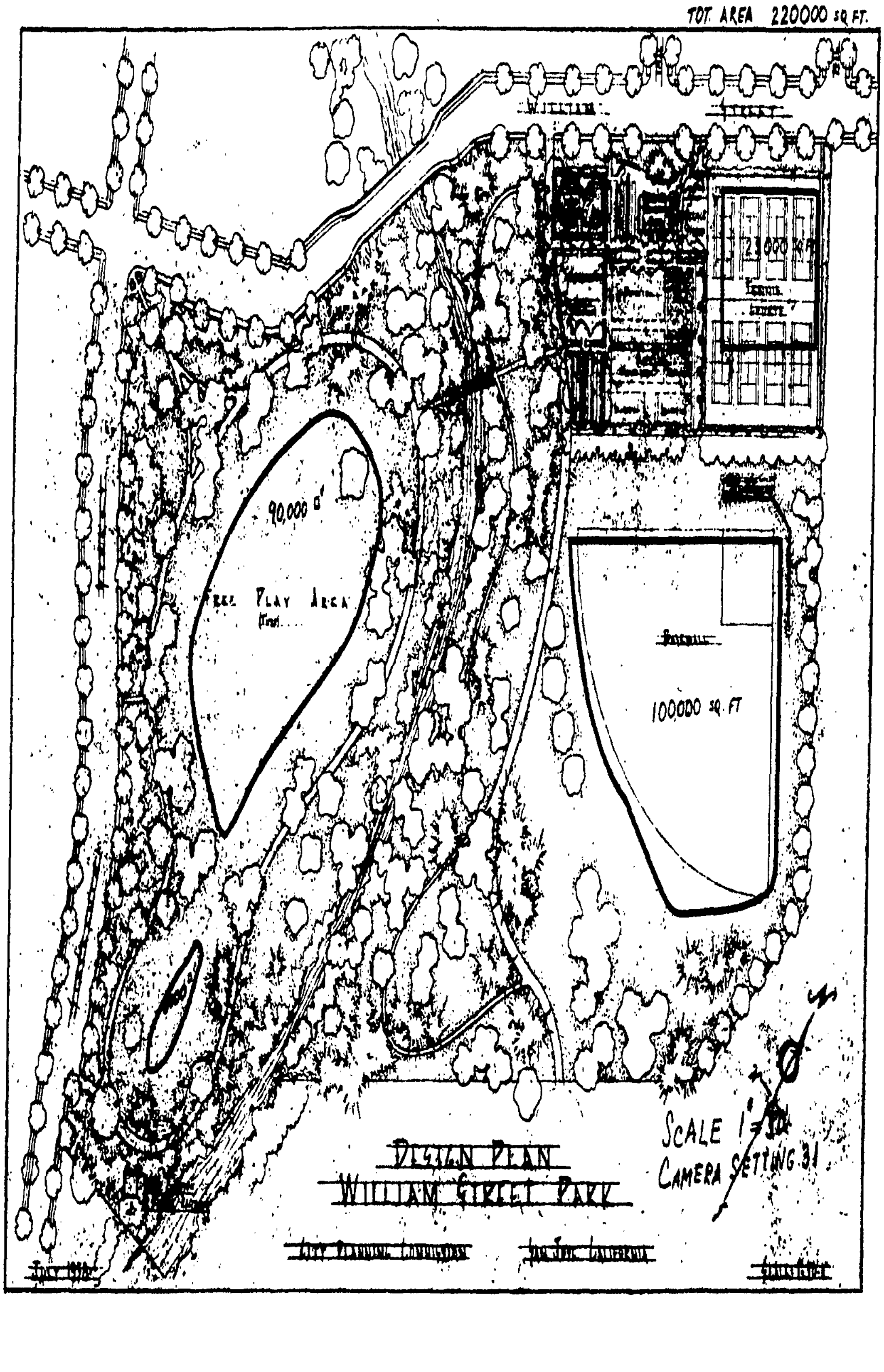

TOTAL AREA: 253,850 SQ FT.
PRELIMINARY DESIGN STUDY
FRED WATSON PARK
CITY PLANNING COMMISSION ~ SAN JOSE, CALIF.
SCALE: 1"=50'0"
JULY 1959
83000 SQ FT
73000 SQ FT
40000 SQ FT
125000 SQ FT
21000 SQ FT
SCALE 1:50'
CAMERA SETTING 17

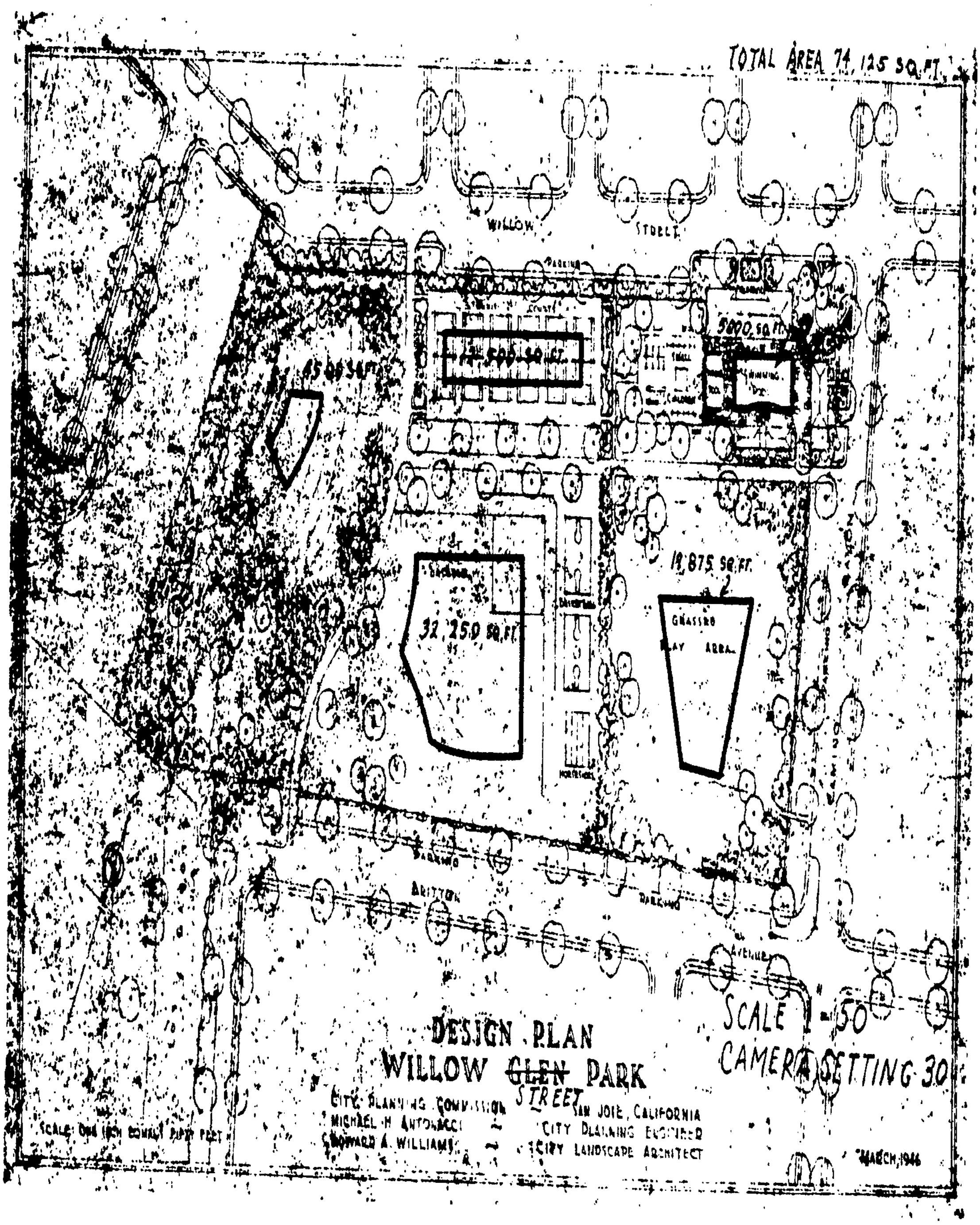
45. WELCH



A PRELIMINARY STUDY PLAN
CUNNINGHAM RECREATION CENTER
CITY PLANNING COMMISSION SAN JOSE CALIF.

47. WILLIAM STREET




TOTAL AREA 74,125 SQ.FT.
WILLOW
STREET
PARKING
5000 SQ.FT.
32,250 SQ.FT.
19,875 SQ.FT.
GRASSED
PLAY AREA
PARKING
BRITTON
AVENUE
DESIGN PLAN
WILLOW ~~GLEN~~ STREET PARK
CITY PLANNING COMMISSION
SAN JOSE, CALIFORNIA
CITY PLANNING ENGINEER
CITY LANDSCAPE ARCHITECT
HOWARD A. WILLIAMS
SCALE 1"=50'
CAMERA SETTING 30
MARCH, 1946

APPENDIX G

PRIVATE SWIMMING POOLS IN SAN JOSE FOR PASSIVE PROTECTION BY WATER SHIELDING

Parts of San Jose may appear to be without much suitable passive protection from nuclear attack. If the potentials for protection by water shielding--described in Appendix C--can be realized in practice, then the standing water in San Jose may need to be added to the protective resources there. High on the list of standing water of possible interest for passive protection is the private swimming pool. There is recorded in this appendix some of the information collected by this study about swimming pools in San Jose.

The approximate distribution of private swimming pools in San Jose appears in Figure 30 in the body of this report. Because of the small scale of the map of Figure 30, and because of the clustering of the pools, it was not feasible to show individual locations; so numbers of pools per Census Tract were indicated. Actual locations of swimming pools were determined and plotted on 2 large scale overlays, and are available at SRI.

These representations were based on data provided by the San Jose City Planning Commission on some 919 pools for which building permits were issued in the period January 1960 through April 1965. For each permit, we were furnished the name, address and estimated cost of construction. These tabulations of nearly a thousand entries will not be reproduced here, but they are available at SRI.

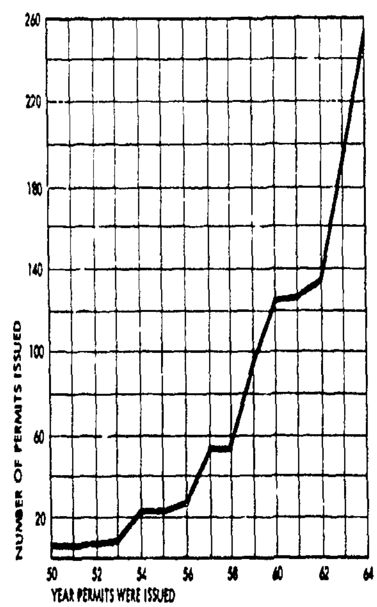
Of the 919 pools presumably built since 1960 all but 44 were successfully located on the large overlays. The failures resulted from: (1) addresses which were not sufficiently specific for pinpoint location, (2) addresses which could not be found, and (3) addresses which were off the map.

From the stated costs of construction a very rough estimate of average size was derived as about 500 sq ft. If 10 sq ft per person were required to use these pools for passive protection, the 919 pools should accommodate something like 46,000 people all together.

According to the "Multiple Housing Report of 1964" by the San Jose Health Department, there were about 297 pools in the area prior to 1960. If these also averaged 500 sq ft each and were usable for passive protection, there would be room in these older pools for nearly another 15,000.

Thus the private swimming pools of San Jose in the aggregate might conceivably provide water shielding for about 50,000 people--a substantial potential resource for protection.

SWIMMING POOL BUILDING PERMITS, 1950 - 1964



SOURCE: City of San Jose, Multiple Housing Report 1964, Department of Health.

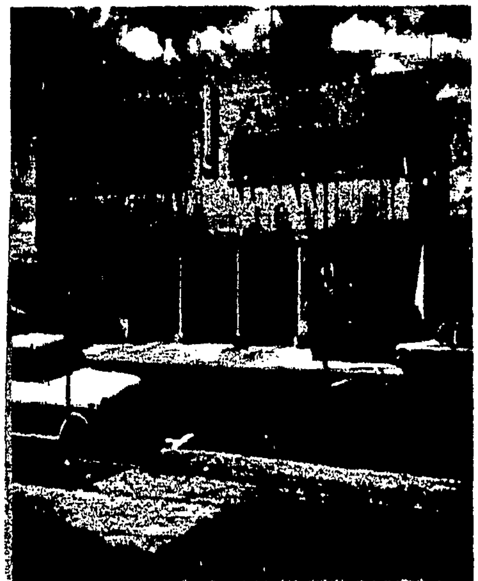
APPENDIX H

FIRE STATIONS OF THE CITY OF SAN JOSE AS NEIGHBORHOOD CIVIL DEFENSE CENTERS

As explained in the middle of Chapter IV, every neighborhood fire station can and should play a bigger role in advancing civil defense in its area than it is now doing. This requires that certain prototype civil defense equipment be available for public examination and demonstration at each fire house. There arises the question whether such installations as home shelters, and group shelters (as appropriate for the given area) can be worked into the grounds of the fire stations in San Jose as they now exist. To make a preliminary check on these possibilities we have looked at all the Fire Stations of the City of San Jose.

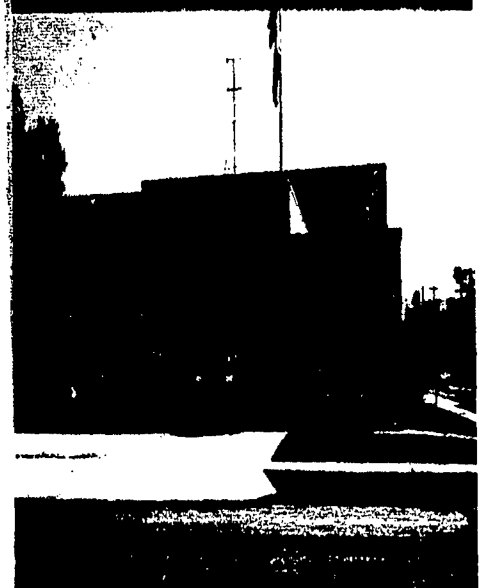
Figure 31 in the body of the report shows the locations of all fire stations in the region of San Jose. Those that are numbered belong to the City of San Jose, and the numbers used are the Fire Station numbers. The maximum distances of the fire stations from the people they serve were determined. The average of those maximum distances turns out to be about 2 miles. Photographs of the San Jose Fire Stations were taken during a reconnaissance of each site, and they are reproduced next in this appendix. Thereafter come plot plans, of each of the stations. The larger originals of these plans were kindly furnished by the San Jose Fire Department. (These are working drawings, not of report quality, reproduced here in case other ideas for their use need checking.) Each of the plot plans has been reviewed for the feasibility of adding sample residential-type shelters for families or groups to the present grounds. From this survey it seemed that the incorporations of prototype civil defense facilities of modest size at Fire Stations, as necessary to advance the program, was entirely practical.

It may be noted that only one Fire Station (#7) has a basement, a small residential-type basement.



1

201 N. Market

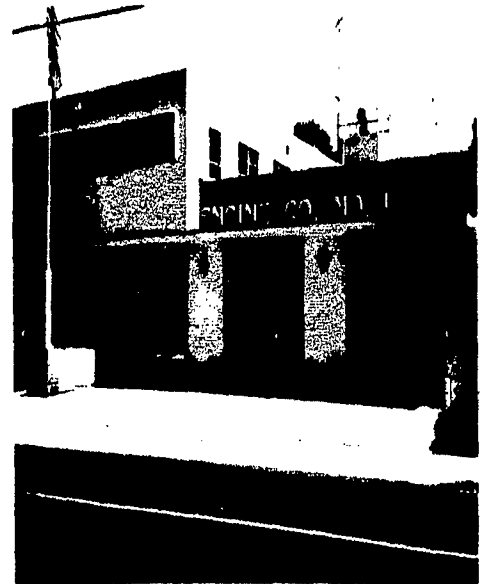


2

304 N. Sixth

3

98 Martha

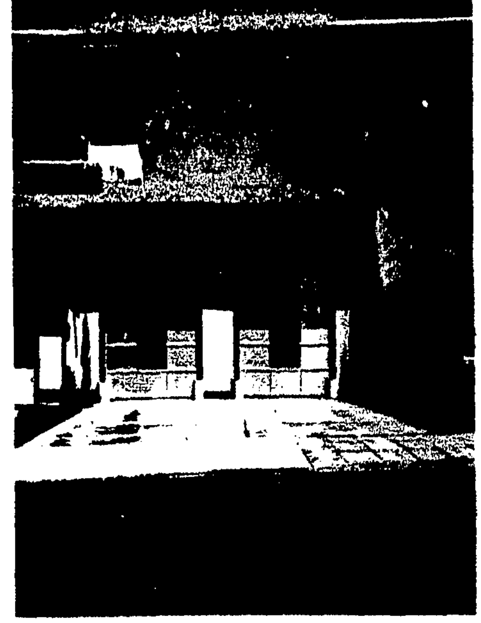


4

454 Anzerais

5

1380 N. Tenth



6

1386 Cherry Avenue

7

800 Emory Street

8

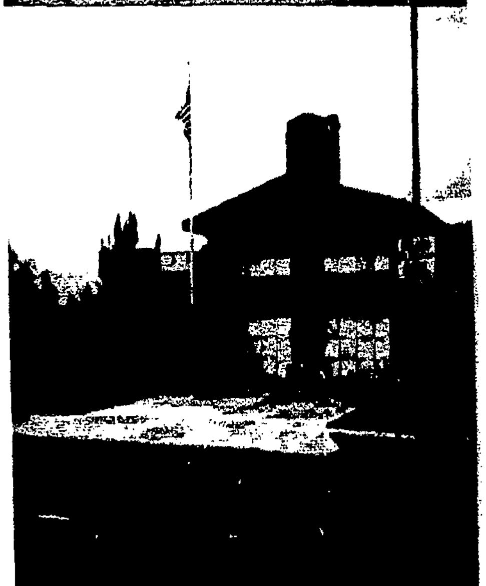
17th and Santa Clara

9

3410 Ross Avenue

10

511 S. Monroe Street



14

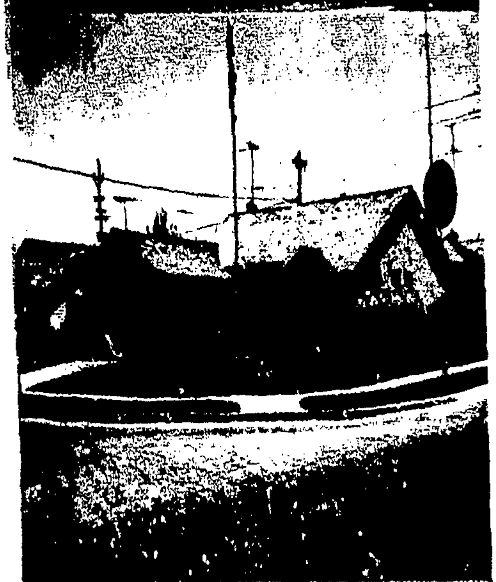
1201 San Tomas Aquino Road

15

1248 Blaney Avenue

16

2001 S. King Road



17

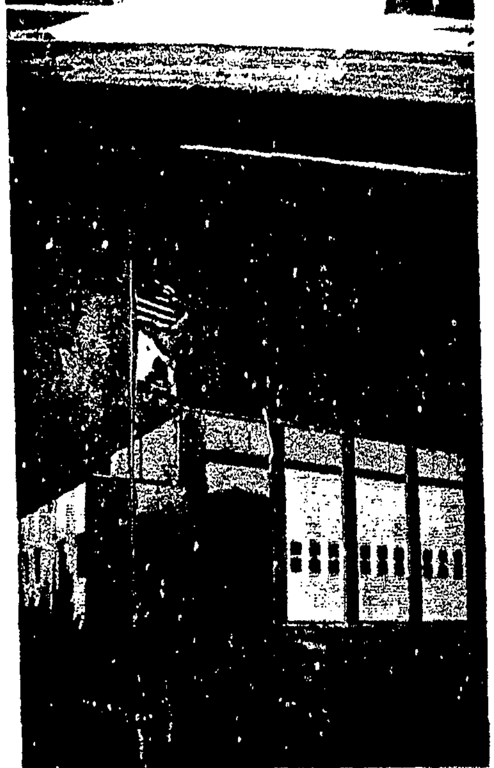
1494 Ridgewood

18

4430 S. Monterey Road

19

1025 Piedmont Road



20

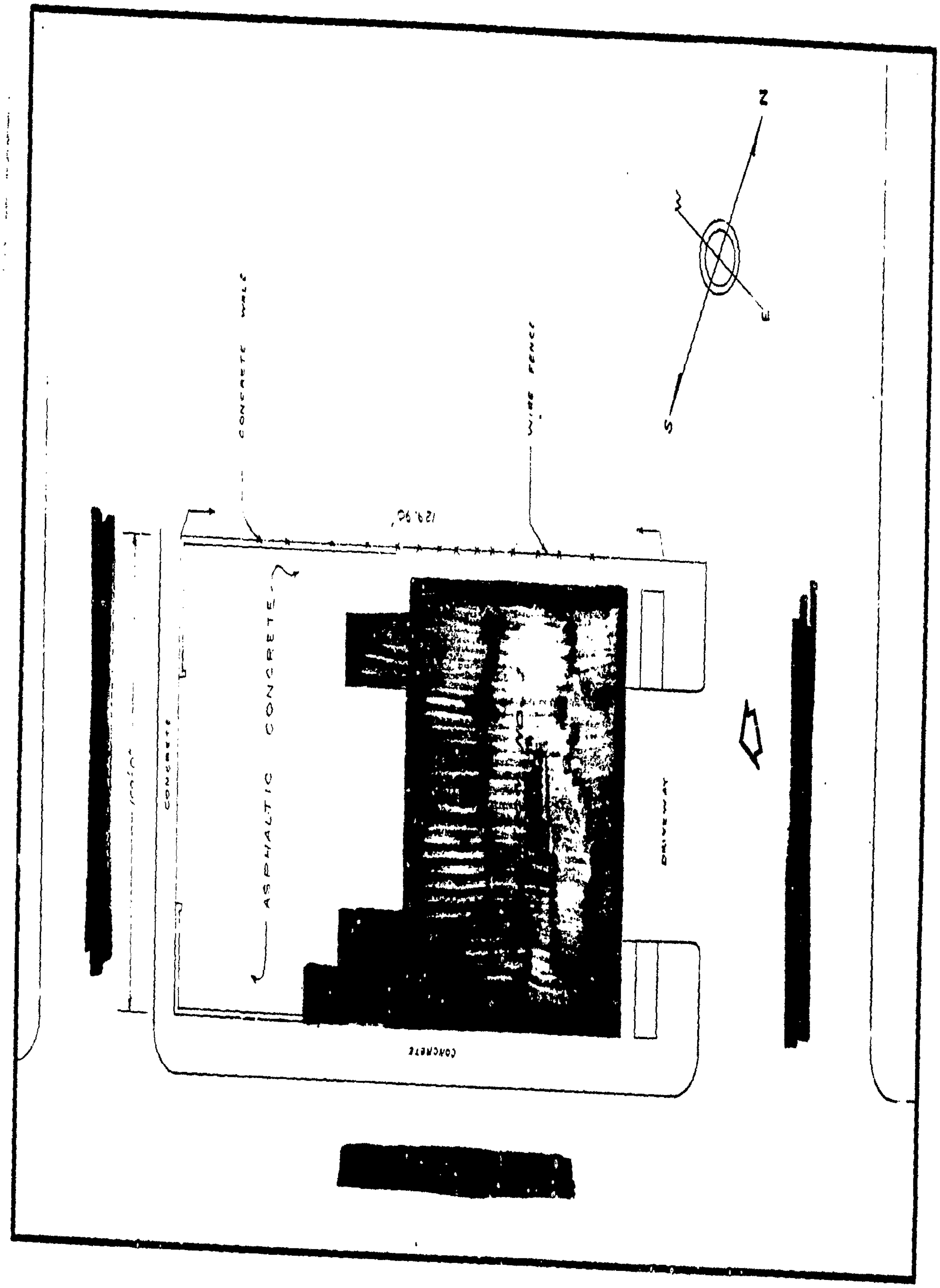
San Jose Municipal Airport

21

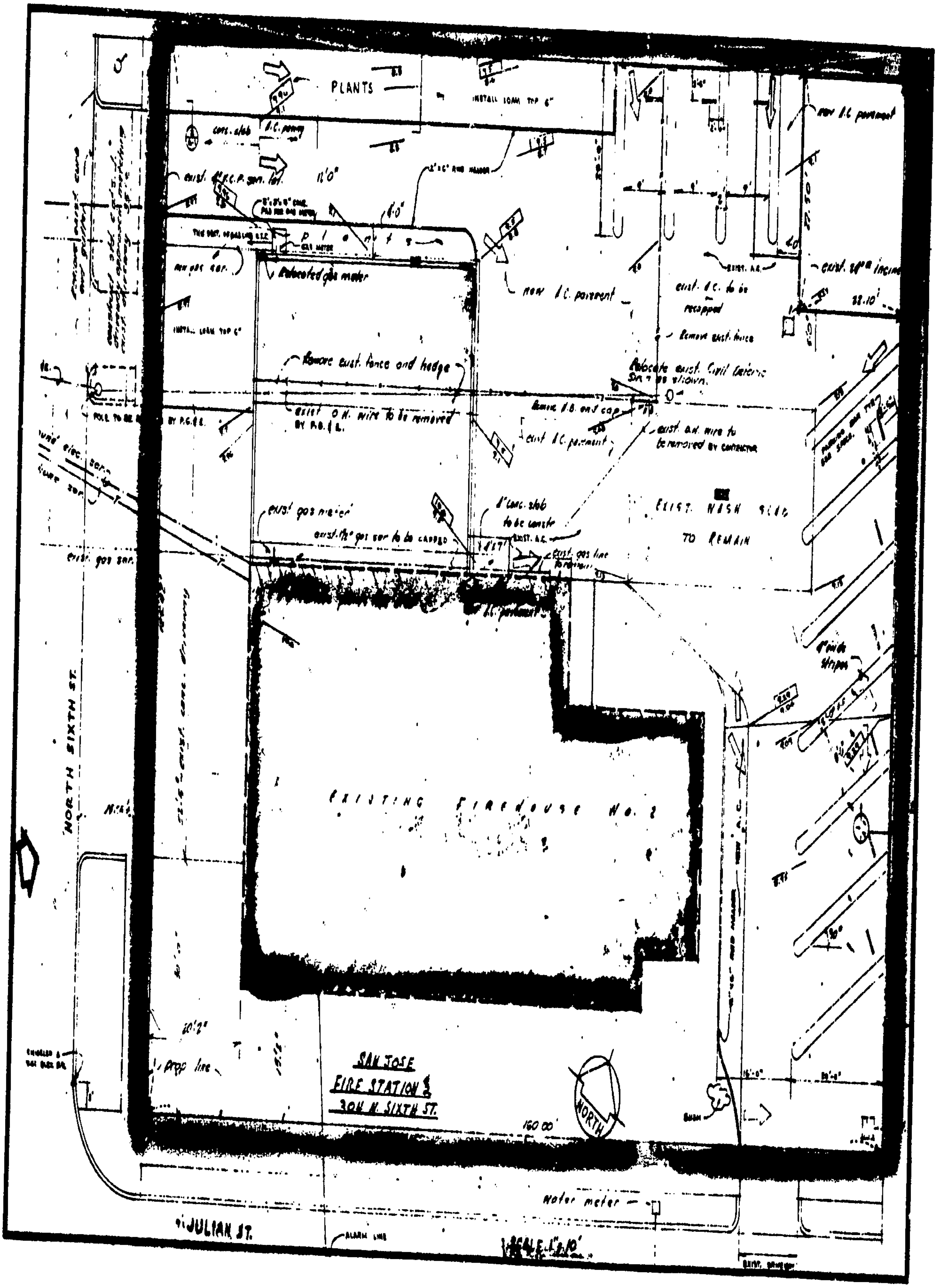
1749 Mount Pleasant Road

Fire Stations 11, 12 and 13 do not exist; Fire Station 22 is under construction.

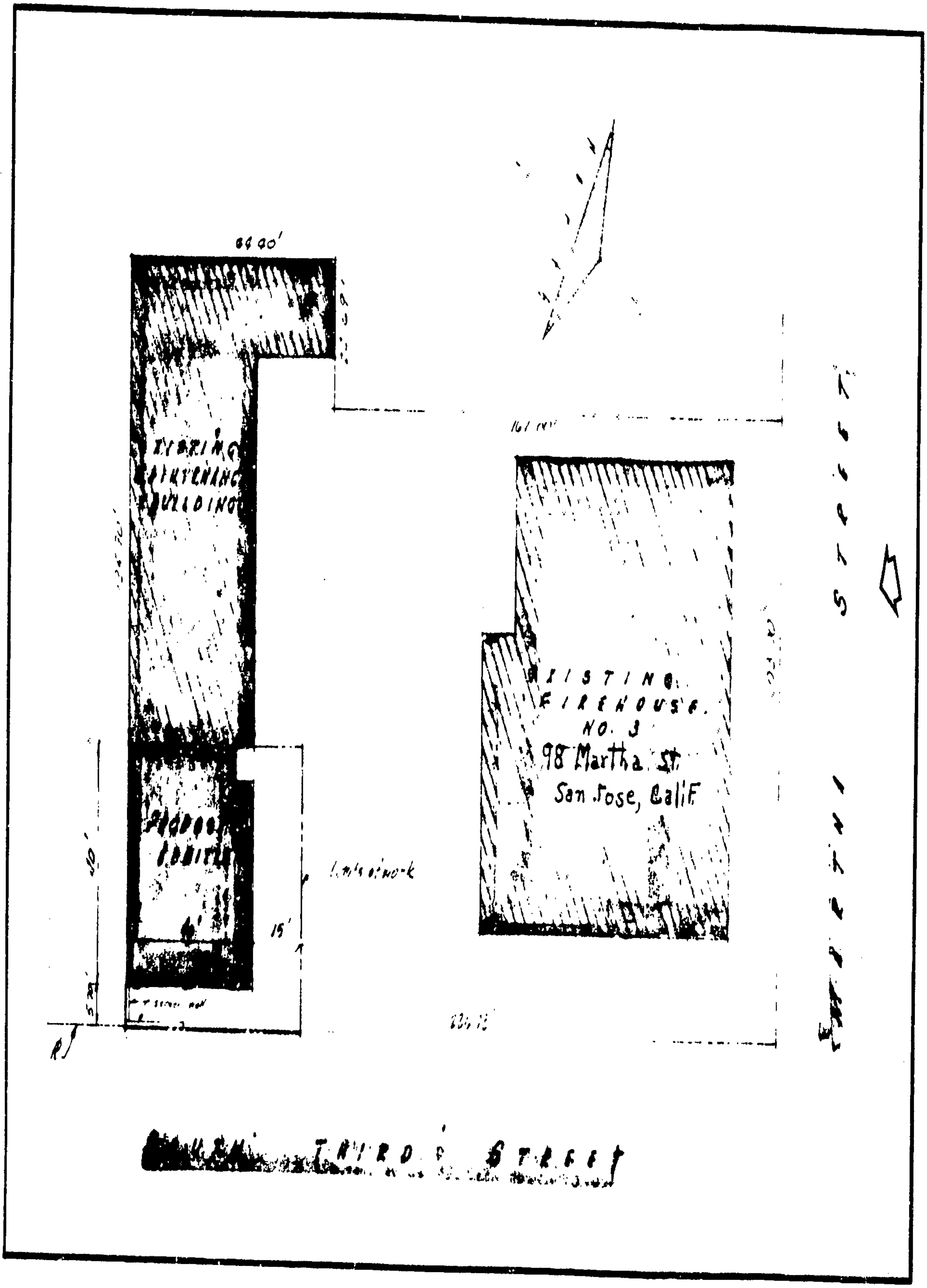
SAN JOSE FIRE STATION NO. 1

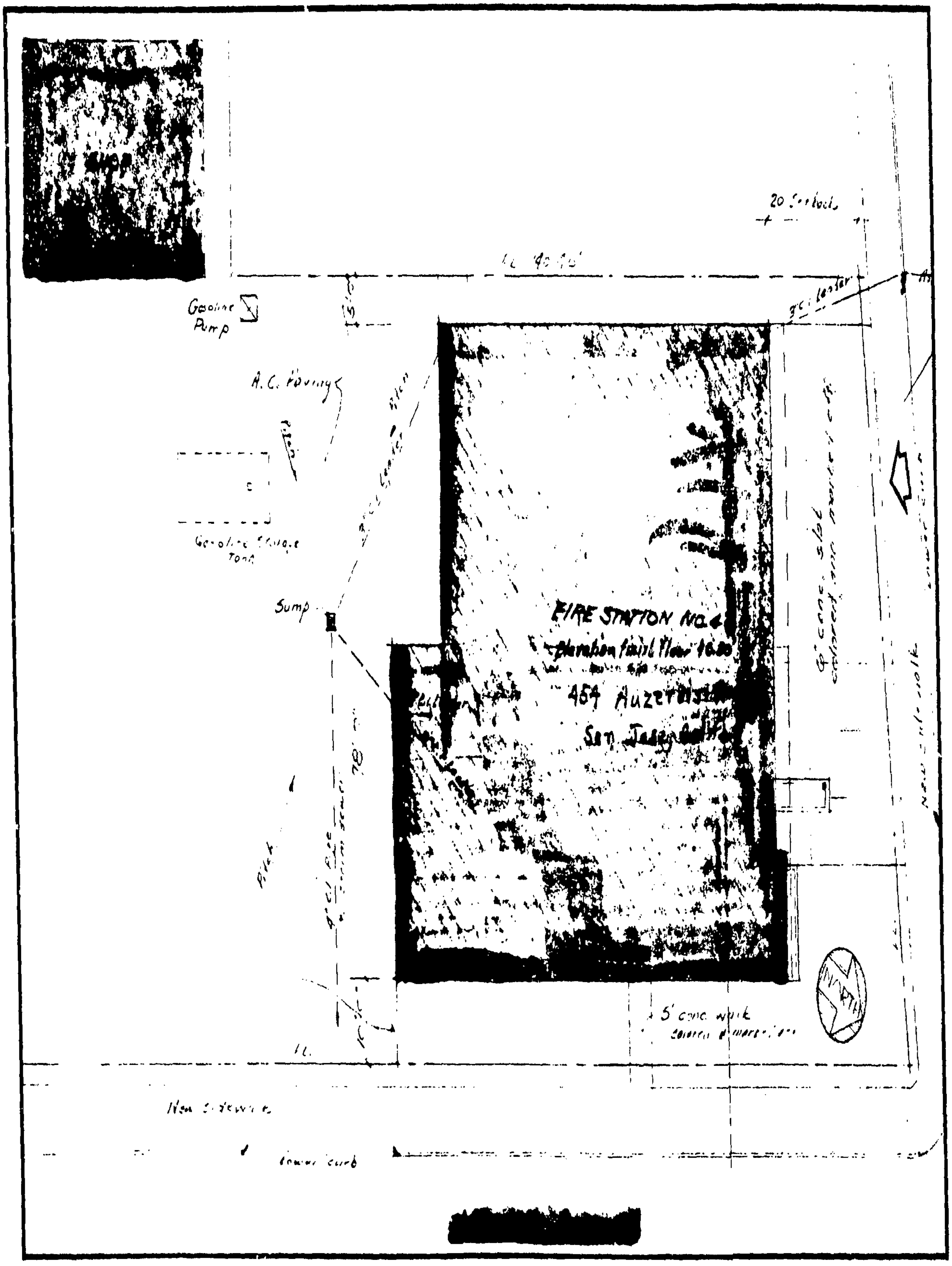


SAN JOSE FIRE STATION NO. 2

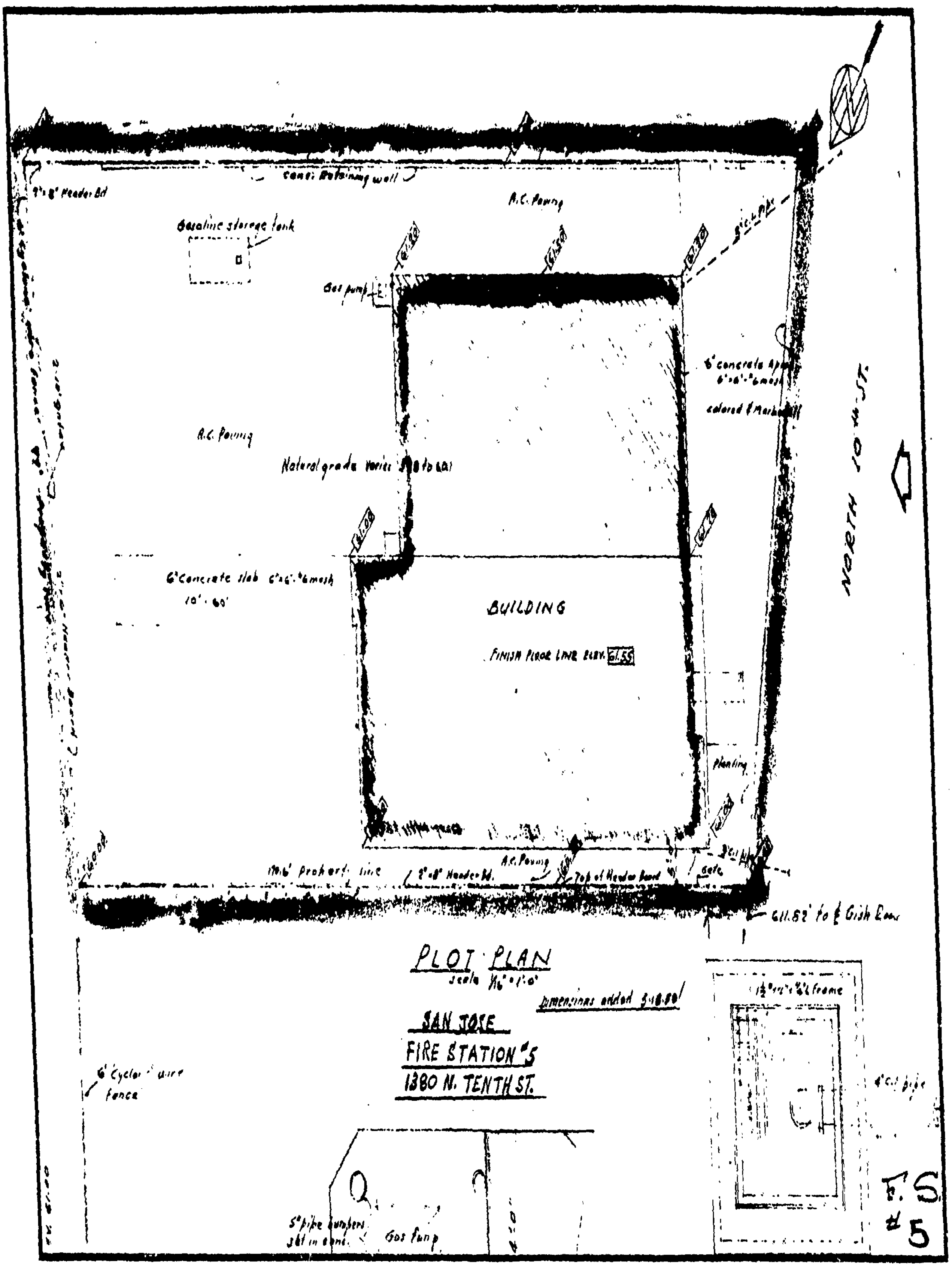


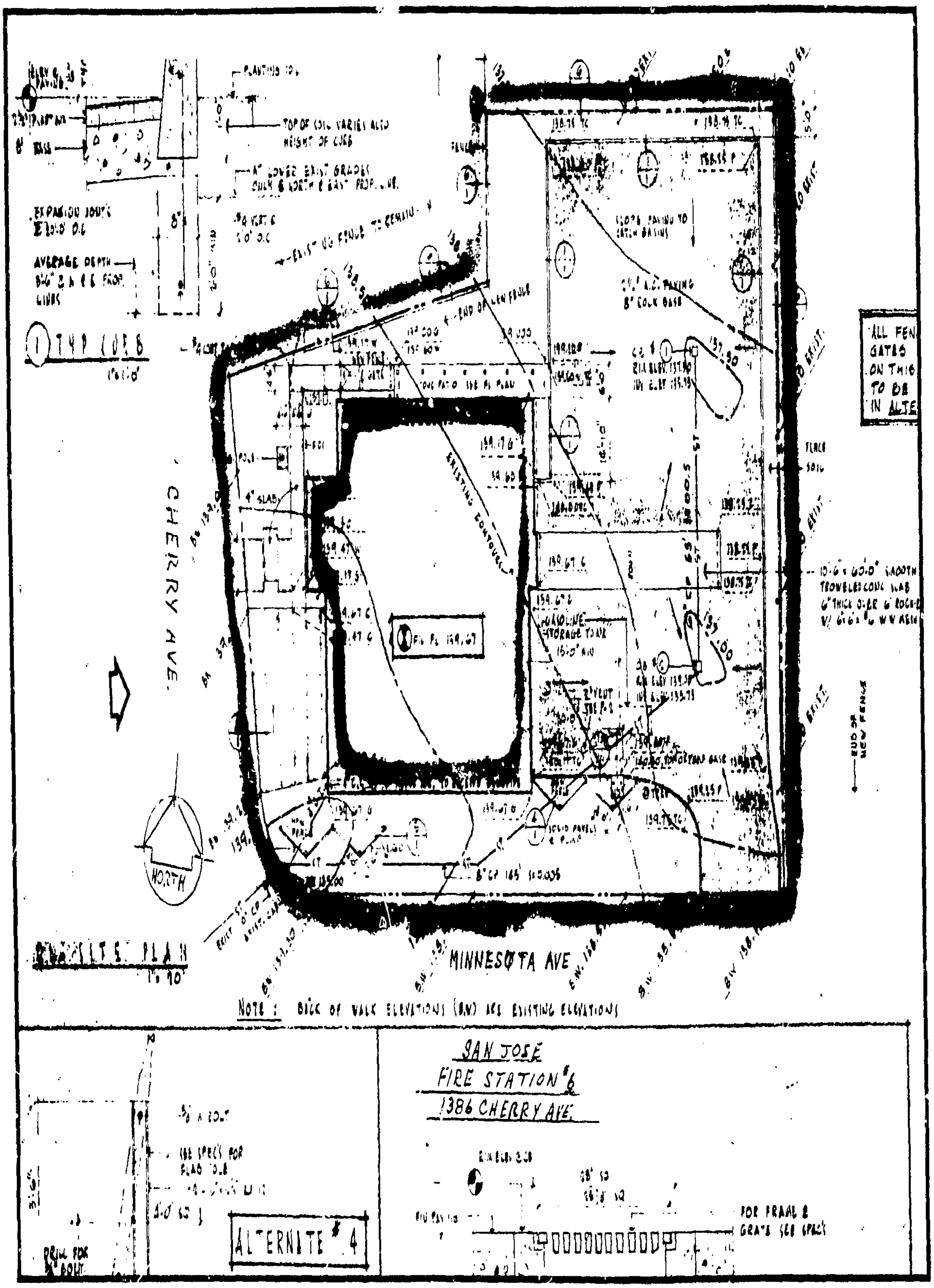
SAN JOSE FIRE STATION NO. 3



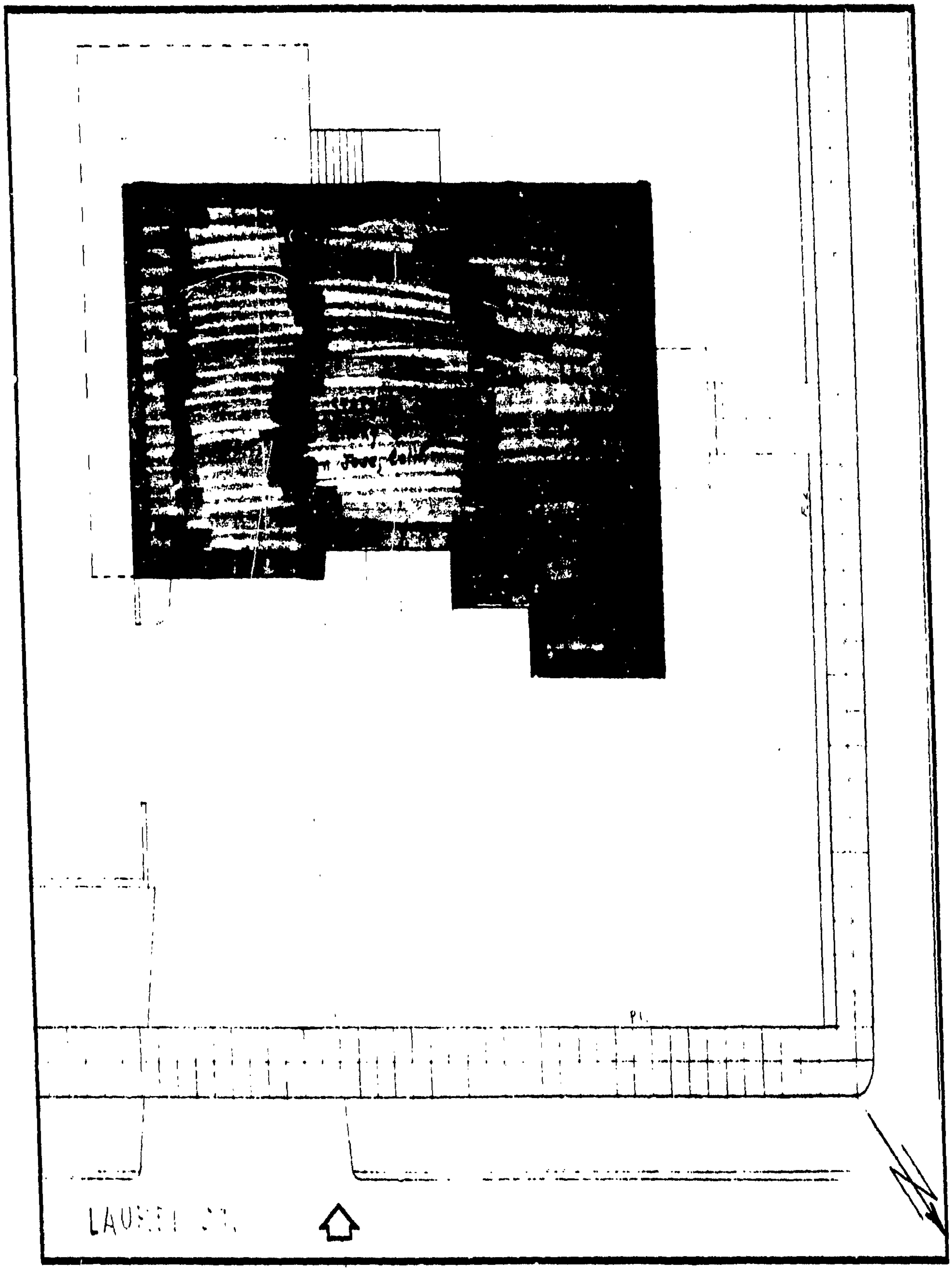


FIRE STATION No. 4
454
Gasoline Pump
A.C. Paving
Sump
5' conc. walk
New sidewalk

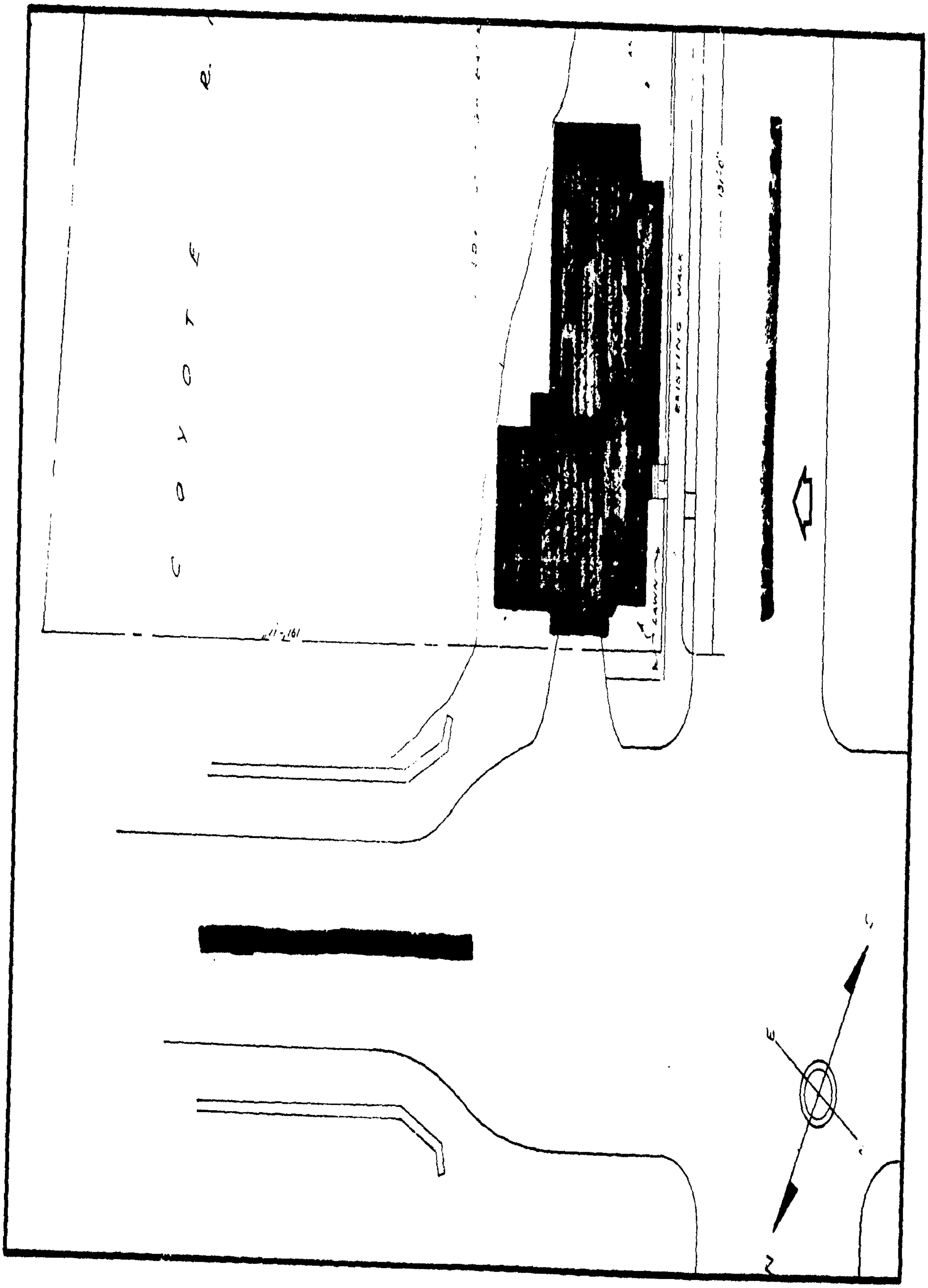

Gasoline storage tank
Gas pump
A.C. Paving
BUILDING
FINISH FLOOR LINE ELEV. 61.55
Natural grade varies
6" Concrete slab
10'·60'
North 10th St.
Planting
Gate
611.52' to ℄ Gish Road
PLOT PLAN
dimensions added
SAN JOSE
FIRE STATION #5
1380 N. TENTH ST.
6' Cyclone wire fence
Gas Pump
F.S. #5

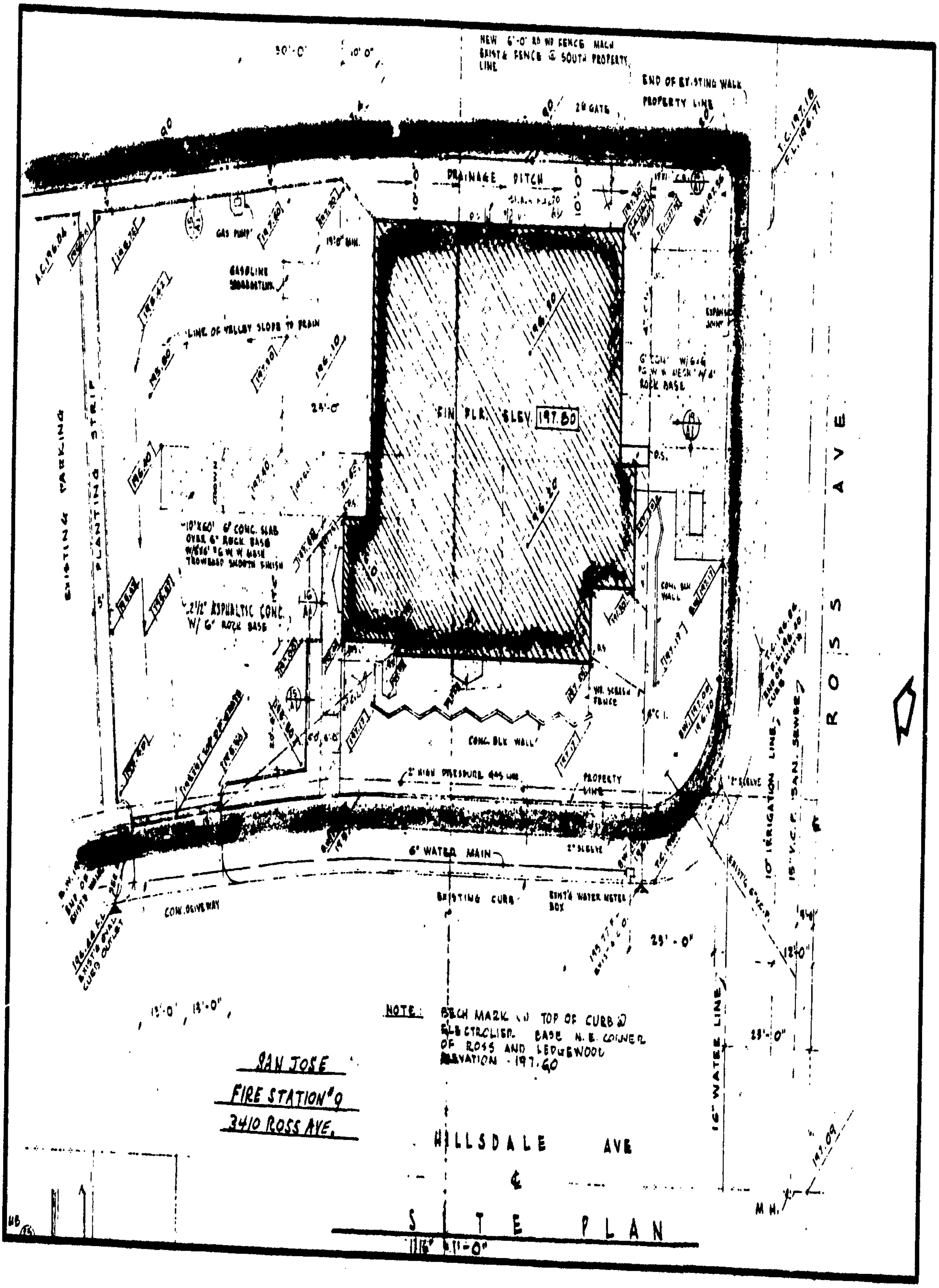

CHERRY AVE.
MINNESOTA AVE
NORTH
TYP CURB
EXISTING CONTOURS
GASOLINE STORAGE TANK
ALL FENCES GATES ON THIS TO BE IN ALTE
NOTE: BACK OF WALK ELEVATIONS (BW) ARE EXISTING ELEVATIONS
SAN JOSE
FIRE STATION #6
1386 CHERRY AVE.
ALTERNITE #4

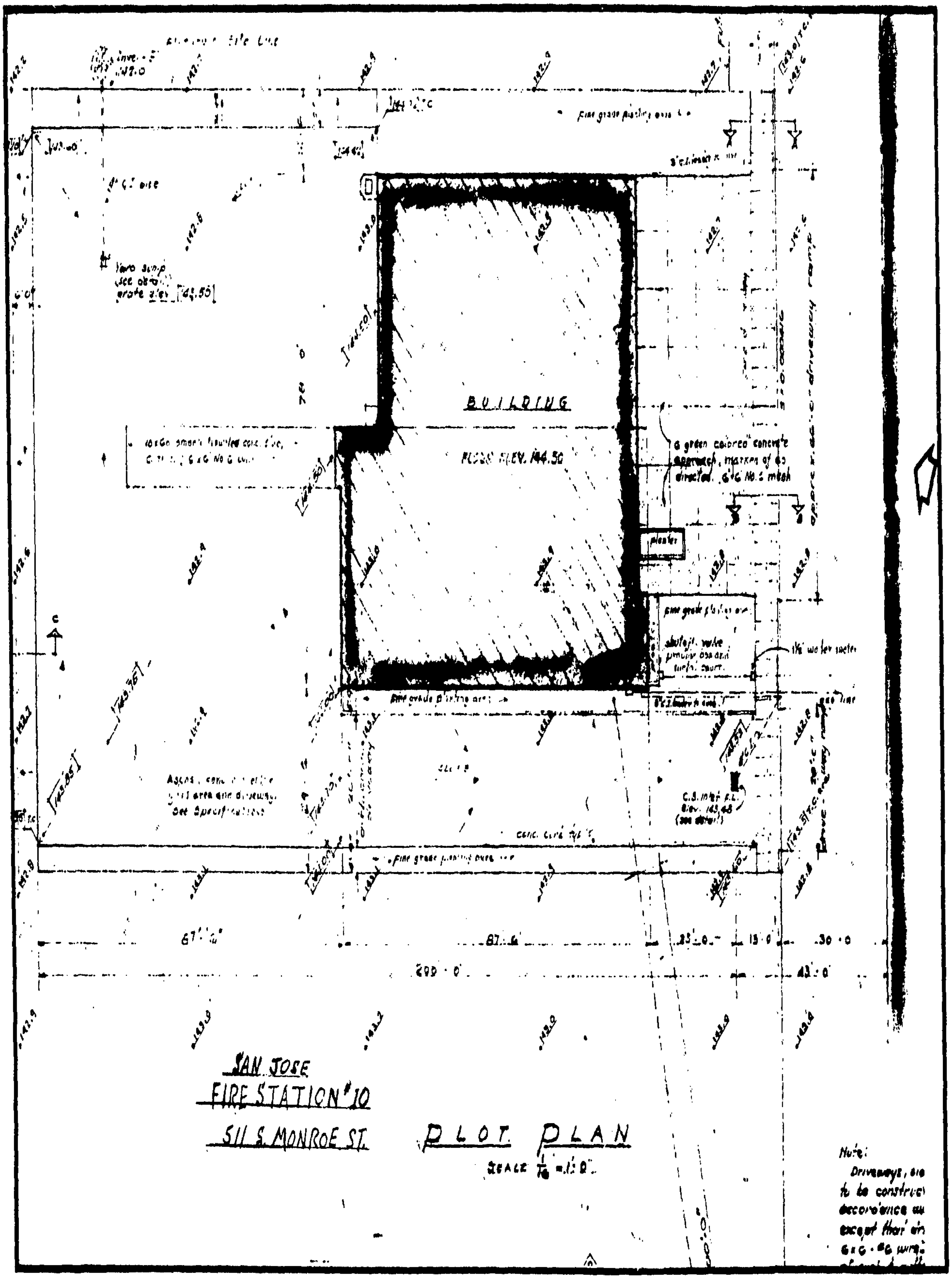
SAN JOSE FIRE STATION NO. 7

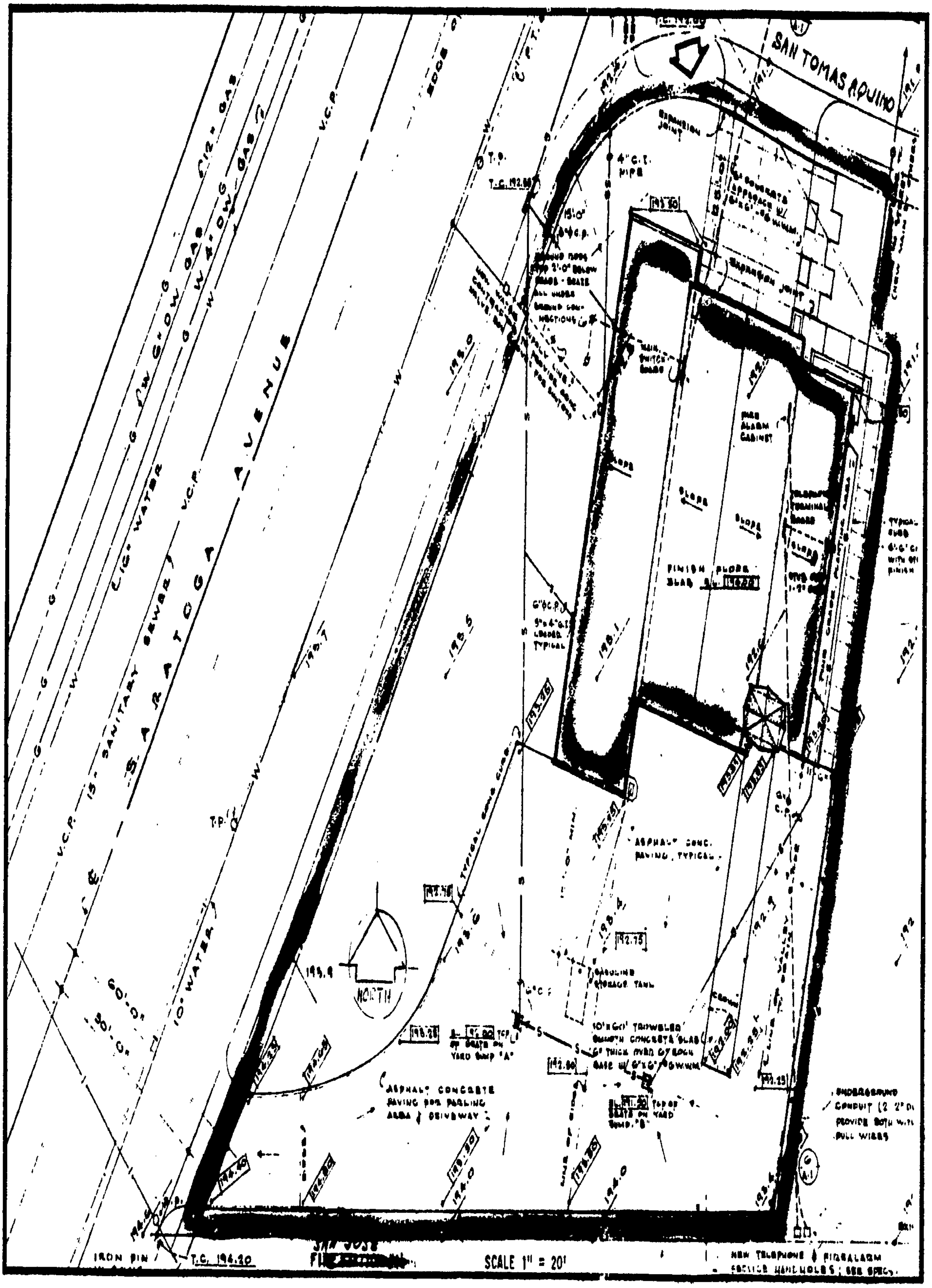


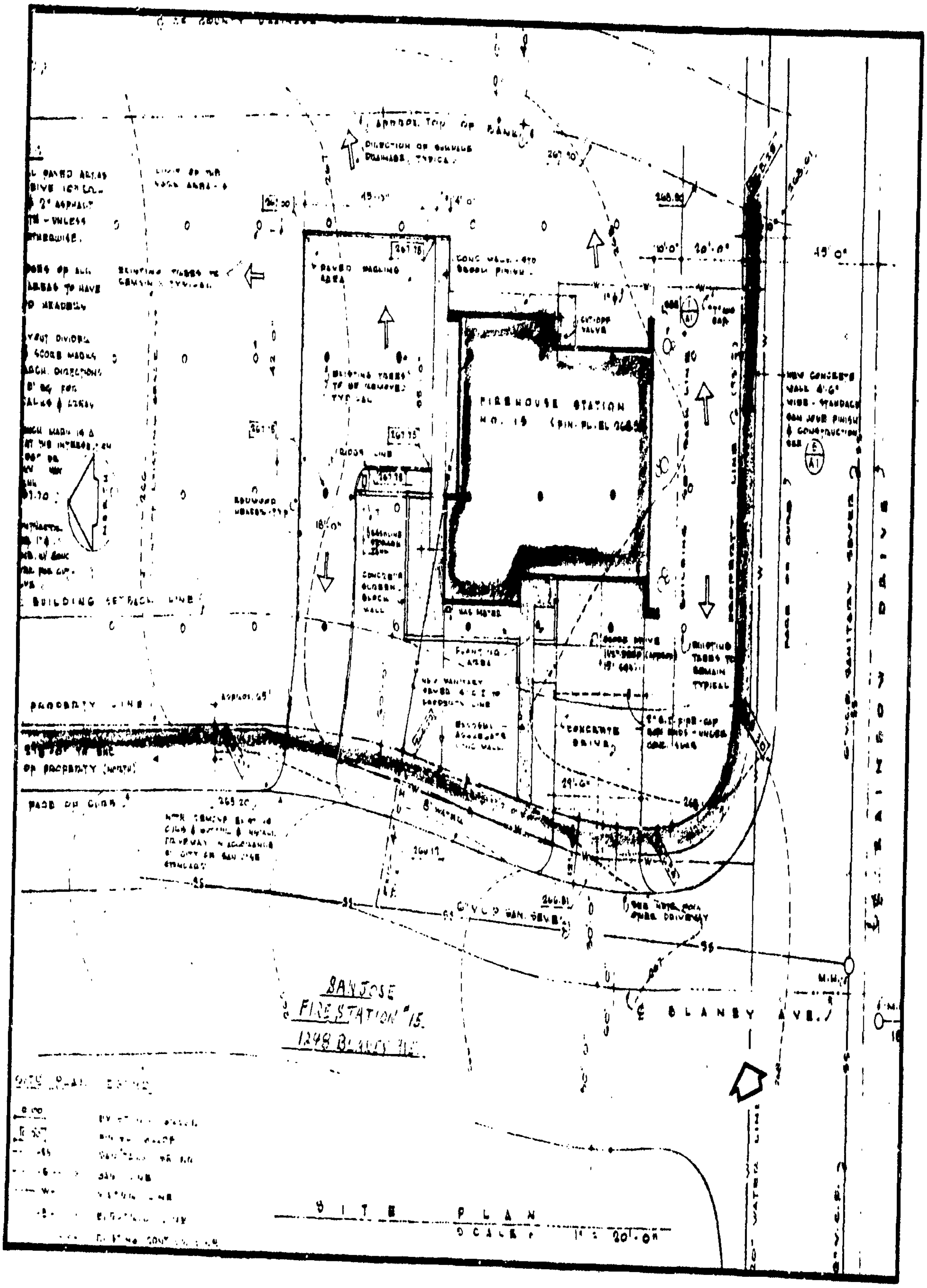
SAN JOSE FIRE STATION NO. 8

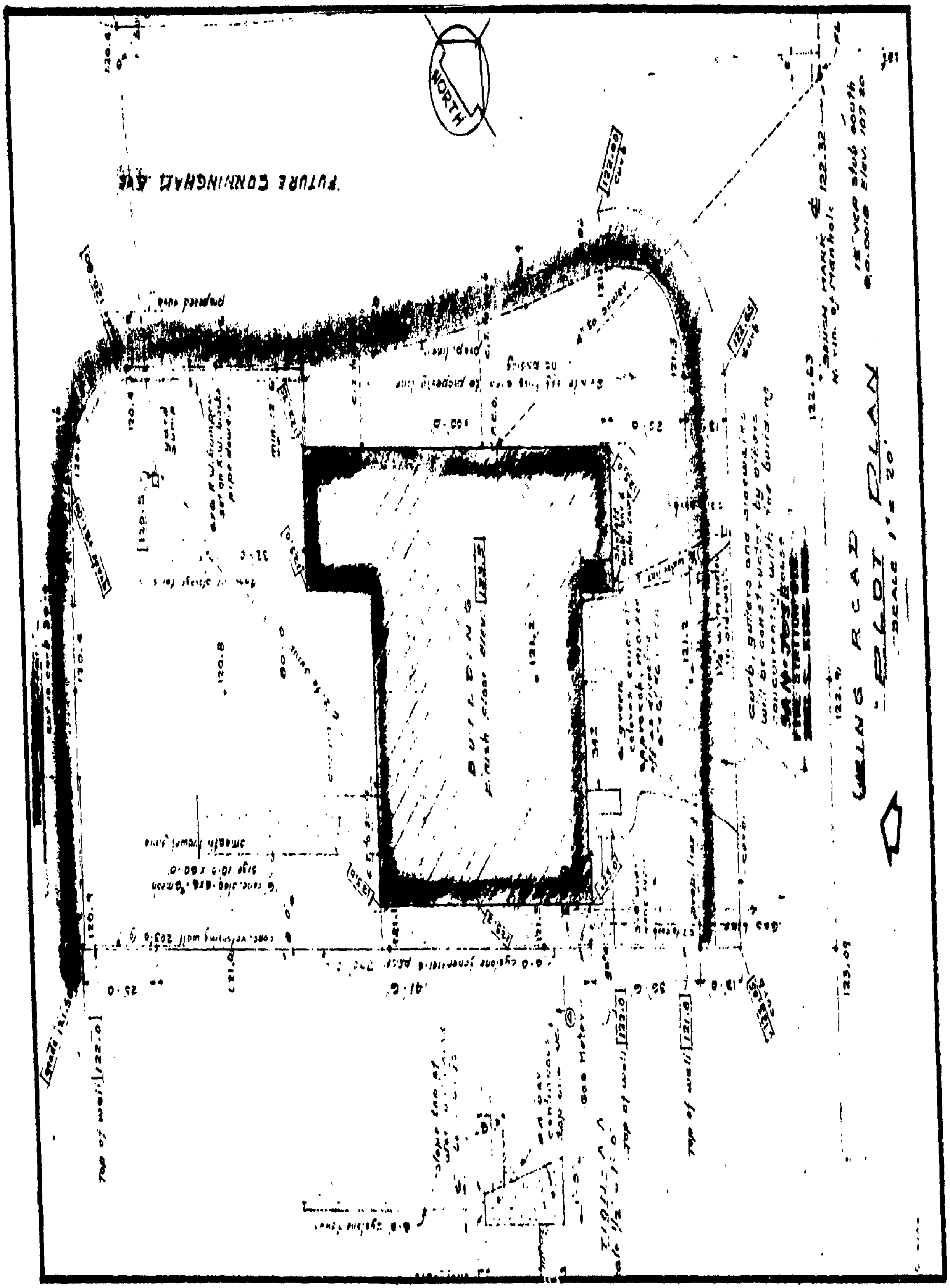


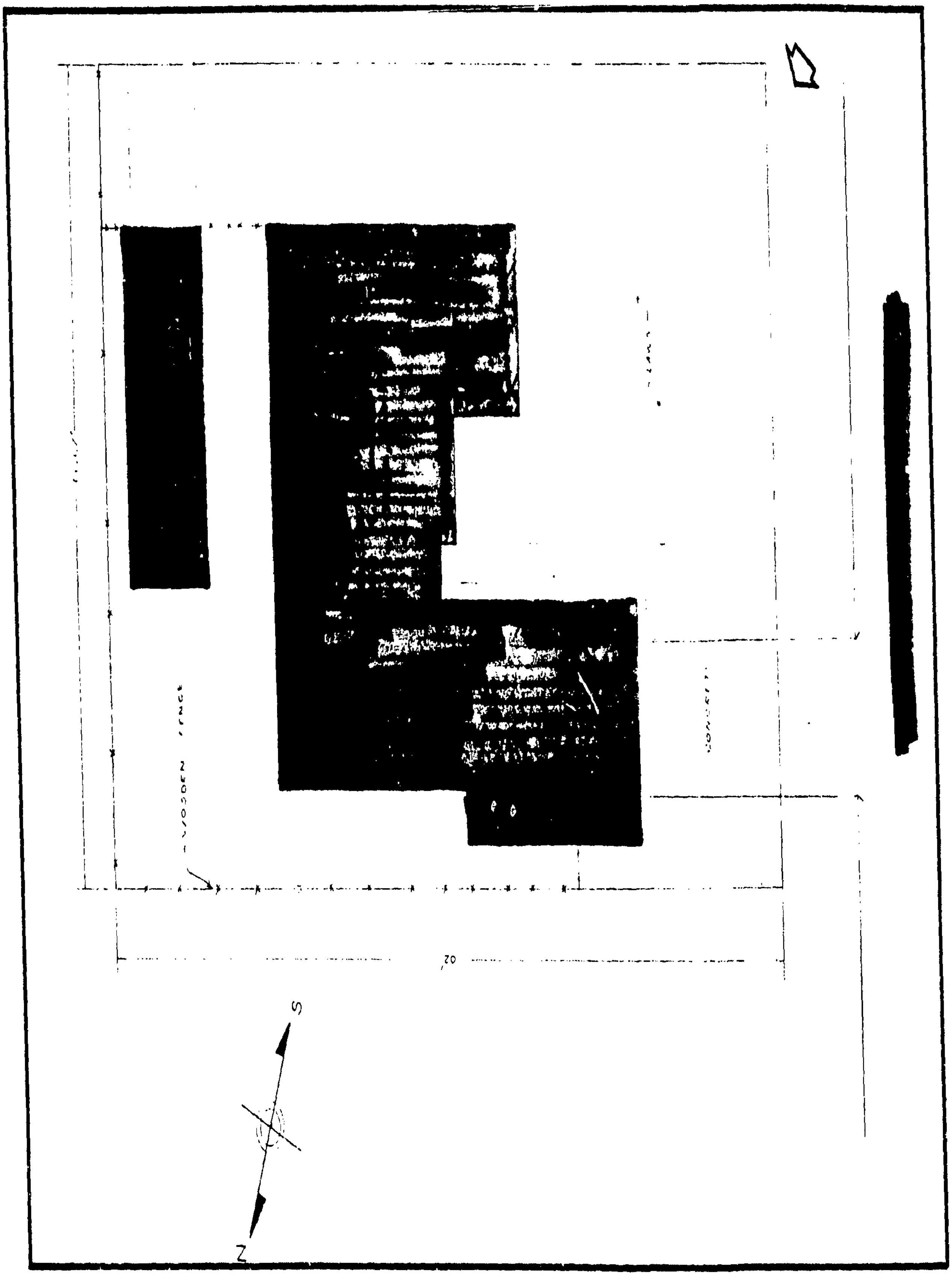

DRAINAGE DITCH
EXISTING PARKING
PLANTING STRIP
GAS PUMP
LINE OF VALLEY SLOPE TO DRAIN
FIN. FLR. ELEV. 197.80
2 1/2" ASPHALTIC CONC. W/ 6" ROCK BASE
CONC. BLK. WALL
2" HIGH PRESSURE GAS LINE
PROPERTY LINE
6" WATER MAIN
EXISTING CURB
CONC. DRIVEWAY
10' IRRIGATION LINE
16" WATER LINE
ROSS AVE
NOTE: BENCH MARK ON TOP OF CURB @ ELECTROLIER BASE N.E. CORNER OF ROSS AND LEDGEWOOD ELEVATION - 197.60
SAN JOSE
FIRE STATION #9
3410 ROSS AVE.
HILLSDALE AVE
SITE PLAN
1/16" = 1'-0"

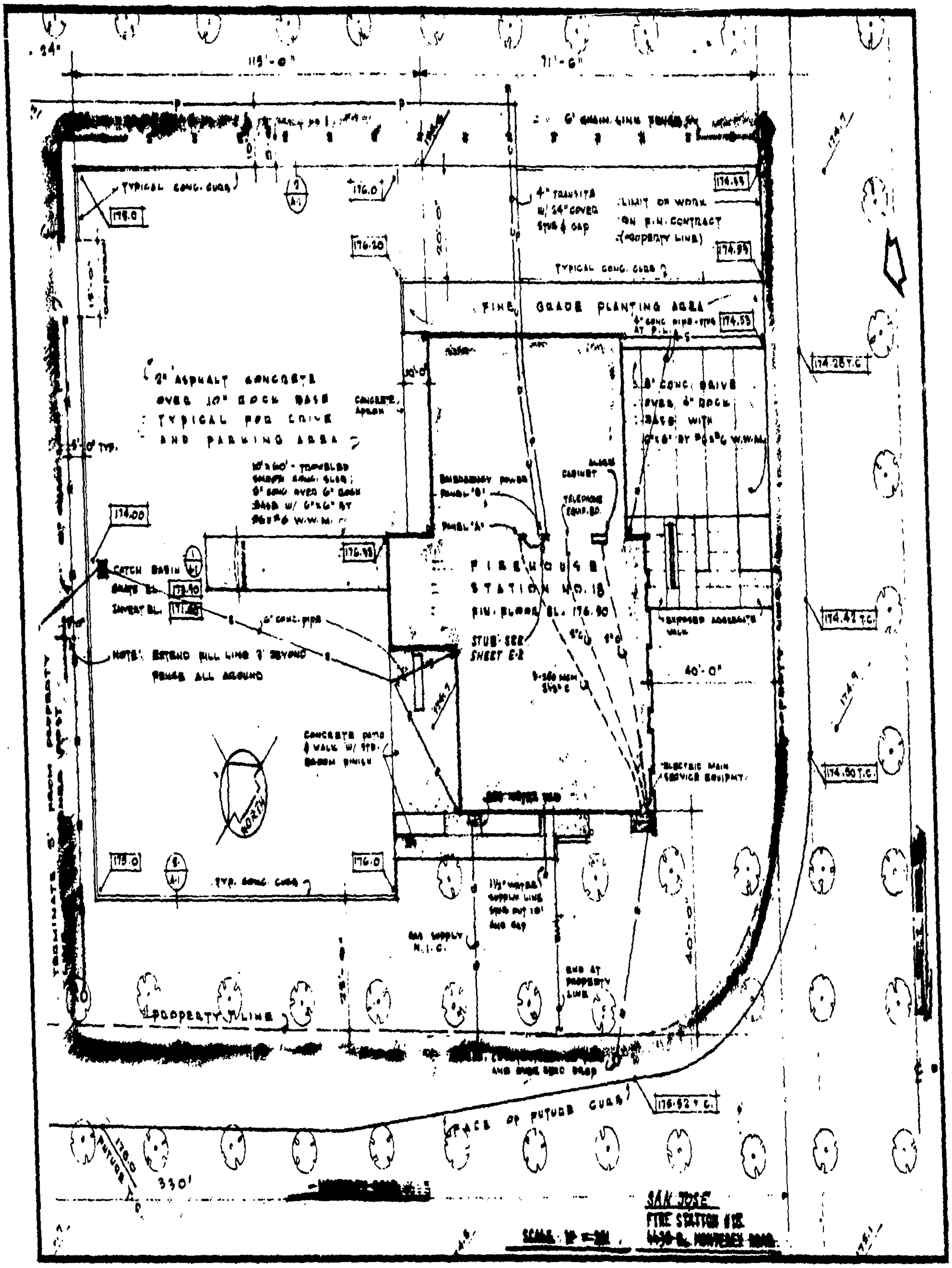

BUILDING
FLOOR ELEV. 144.50
SAN JOSE
FIRE STATION #10
511 S. MONROE ST.
PLOT PLAN
290'-0"
Note:
Driveways are to be constructed in accordance with ... except that the 6x6 - #6 wire ...

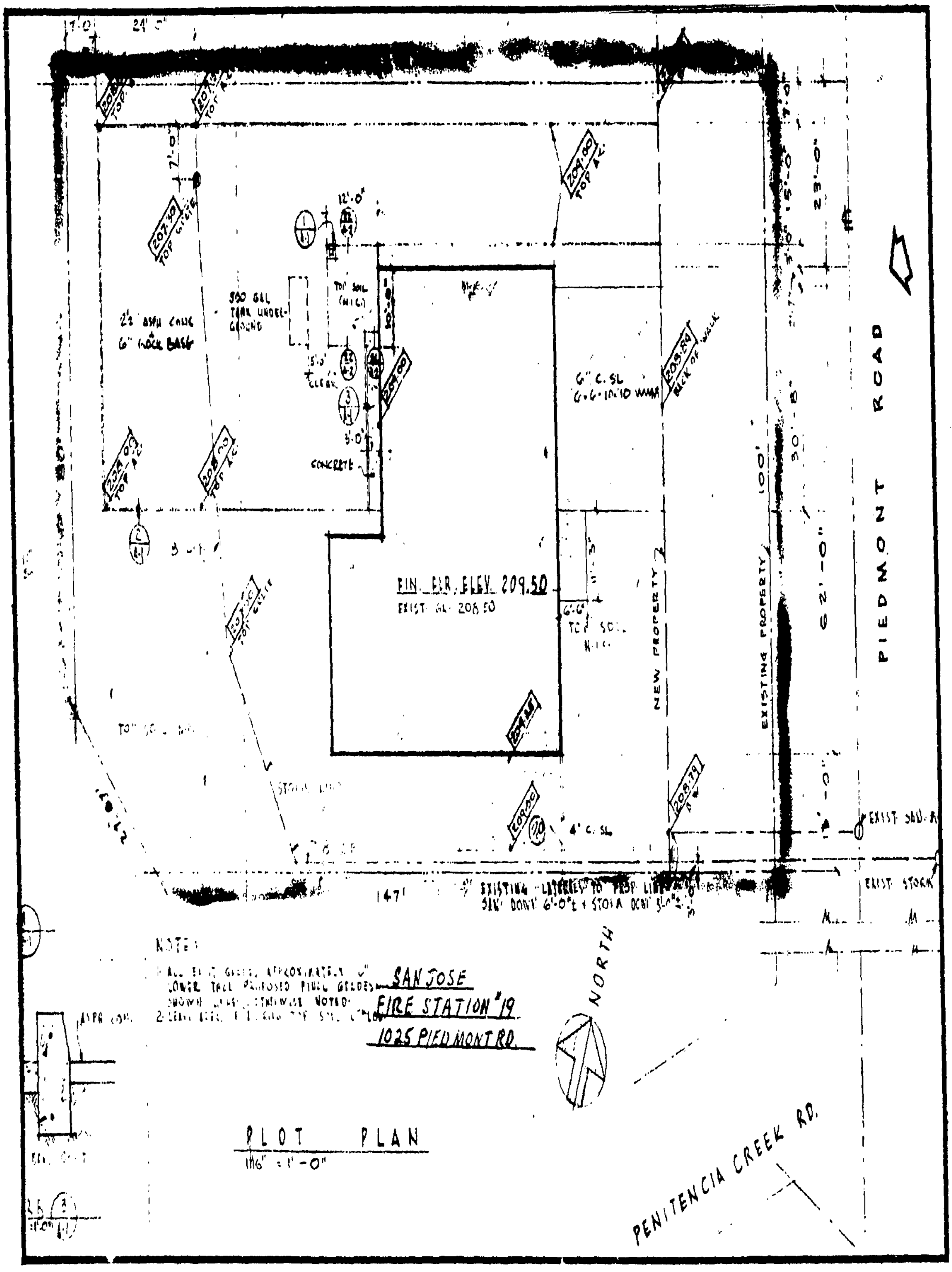

SAN TOMAS AQUINO
SARATOGA AVENUE
12" GAS
6" W. G. GAS
4" W. G. GAS
16" WATER
15" SANITARY SEWER
V.C.P.
10" WATER
EXPANSION JOINT
4" C.I. PIPE
MAIN SWITCH BOARD
FIRE ALARM CABINET
SLOPE
FINISH FLOOR SLAB EL.
ASPHALT CONC. PAVING, TYPICAL
GASOLINE STORAGE TANK
ASPHALT CONCRETE PAVING FOR PARKING AREA & DRIVEWAY
NORTH
IRON PIN
T.C. 194.20
T.C. 192.88
TYPICAL CURB
UNDERGROUND CONDUIT
NEW TELEPHONE & FIREALARM SERVICE HANDHOLES; SEE SPECS.
SCALE 1" = 20'

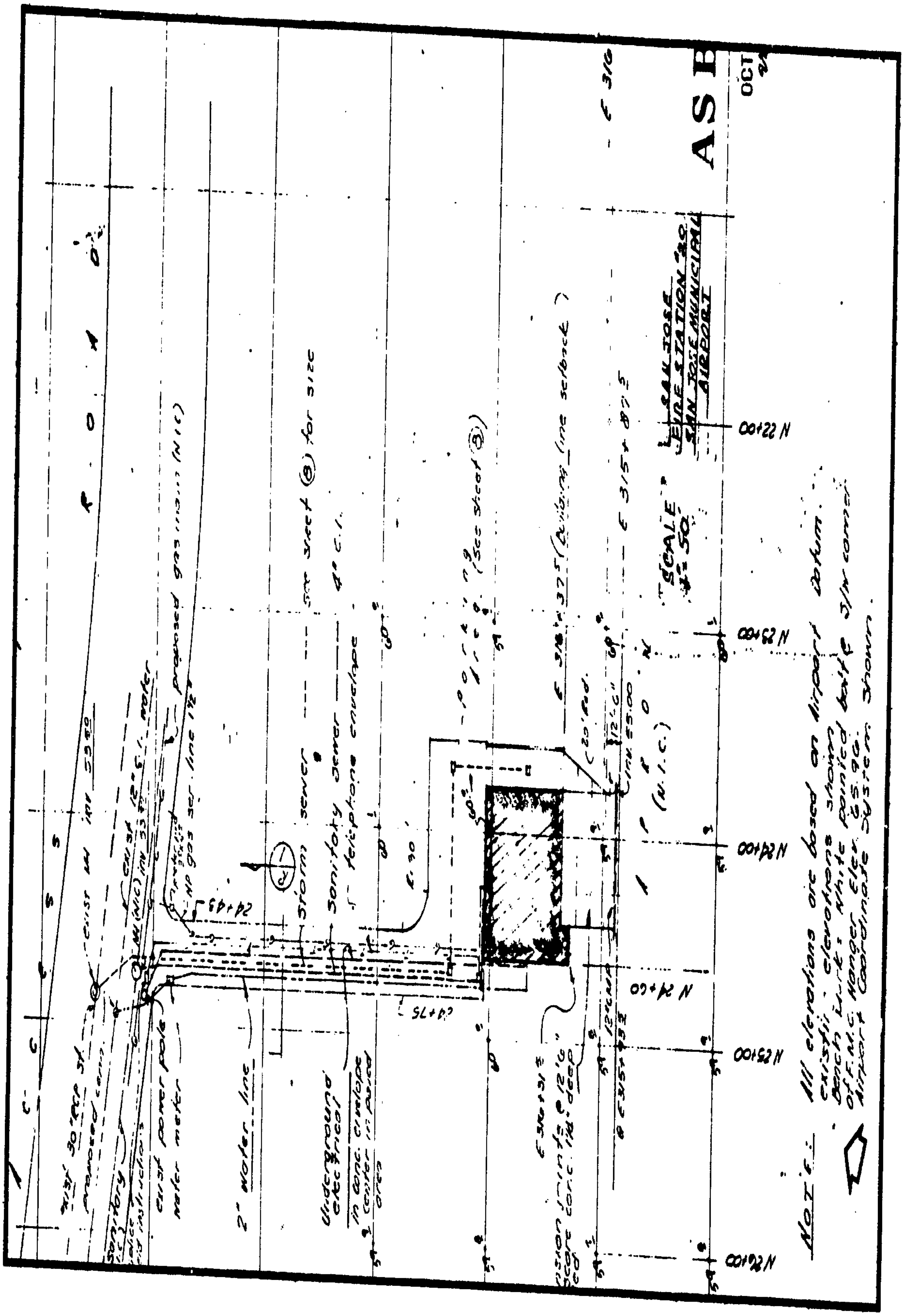

FIREHOUSE STATION
NO. 15
BUILDING SETBACK LINE
PROPERTY LINE
CONCRETE DRIVE
BLANEY AVE.
SAN JOSE
FIRE STATION #15
SITE PLAN
SCALE 1" = 20'-0"

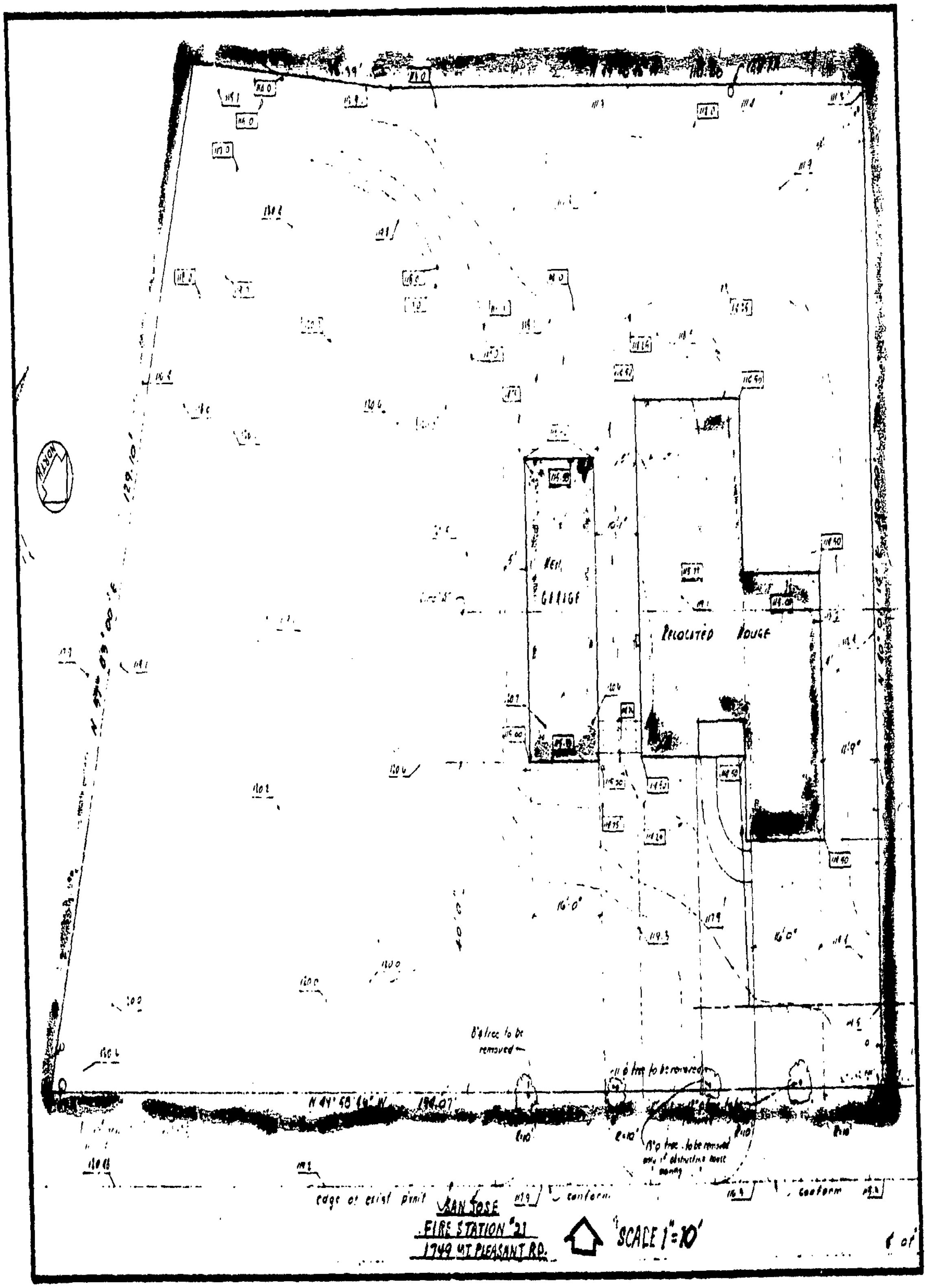

NORTH
FUTURE CUNNINGHAM AVE
PLOT PLAN
SCALE 1" = 20'


20'
WOODEN FENCE
S
N


115'-0"
71'-6"
TYPICAL CONC. CURB
LIMIT OF WORK ON F.H. CONTRACT (PROPERTY LINE)
FINE GRADE PLANTING AREA
TYPICAL FOR DRIVE AND PARKING AREA
CATCH BASIN
NOTE: EXTEND FILL LINE 2' BEYOND FENCE ALL AROUND
STUB-SEE SHEET E-2
NORTH
40'-0"
PROPERTY LINE
FACE OF FUTURE CURB
330'
SAN JOSE


PIEDMONT ROAD
FIN. FLR. ELEV. 209.50
EXIST. GL. 208.50
NEW PROPERTY
EXISTING PROPERTY
500 GAL TANK UNDERGROUND
CONCRETE
NOTES:
SAN JOSE
FIRE STATION #19
1025 PIEDMONT RD.
NORTH
PLOT PLAN
1/16" = 1'-0"
PENITENCIA CREEK RD.


SAN JOSE
FIRE STATION NO 20
SAN JOSE MUNICIPAL
AIRPORT
SCALE 1" = 50'
N 22+00
N 23+00
N 24+00
N 25+00
N 26+00


NEW GARAGE
RELOCATED HOUSE
N 44° 58' 14" W 194.07'
edge of exist pvmt
conform
SAN JOSE
FIRE STATION #21
1749 MT PLEASANT RD.
SCALE 1"=10'

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4 DESCRIPTIVE NOTES (Type of report and inclusive dates) Final Report	
5 AUTHOR(S) (Last name, first name, initial) Richard I. Condit	

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13 ABSTRACT

This report describes how a community may build up passive protection against the direct effects and/or the radioactive fallout from nuclear explosions. General concepts are presented, and specific applications are made to the City of San Jose, Calif., (pop. about 300,000). The extent of the passive protection employed is correlated with a reduction in the effective size of enemy weapons. The means for obtaining various degrees of passive protection for entire communities are indicated, and cataloged for San Jose. Included are the protection of (1) existing structures and facilities, (2) additions to and upgrading of shelters, (3) increased emergency-readiness measures, and (4) new shelter construction. And the indispensable support systems for shelter--training, warning, communications, radiological monitoring, emergency direction and control--are related to the array of protective facilities. Large incombustible open areas within the community are shown to be uniquely favorable sites for new facilities--either expedient or permanent--to be protective against the direct effects of blast and fire. The public school grounds and parks in San Jose are shown to be suitable in size and location for the prompt protection of the population there. When protecting against direct effects, downtown San Jose is shown to be more hazardous than the remainder. Eight area-wide shelter systems are finally developed and evaluated for San Jose: Four for protection from direct effects and fallout; four for protection against fallout only. Charecteristic curves of ultimate performance are presented for each system.

DD FORM 1 JAN 64 1473

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14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Shelter systems						
Community protection						
Civil defense against direct effects						
Civil defense against fallout						
Elements of protection						

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